DOE/EH-0531(3Q96)

ES&H

Office of Environment, Safety and Health

Performance Indicators for ES&H

Report Period
Ending September 1996

February 1997

DOE Operating Experience Analysis

Safety Management Through Analysis

This report is available via the World Wide Web at: http://www.eh.doe.gov/pi

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Foreword

This performance indicator report, which includes data up to the period ending in September 1996, is an important part of ongoing efforts by the Office of Environment, Safety and Health to improve the analytic tools available to line managers as we seek continuous improvement in ES&H performance throughout the Department of Energy.

The report incorporates suggestions we have received from customers. Readers will note that we have added four new indicators — electrical safety, transportation safety, industrial operations, and plutonium stabilization. Four indicators were dropped because they either were not informative or could not be supported by reliable data. We will continue to work to improve the quality and usefulness of these reports and appreciate your continued comments.

Like any large industrial organization, DOE needs to produce complete, timely and accurate ES&H data to manage operations effectively and to fulfill its responsibilities to the public. EH is committed to providing line managers with timely data and reliable information that will raise questions and stimulate program and field office managers to analyze their own site-specific data in more detail and in real time. Effective and efficient ES&H programs are fundamentally dependent on our ability to understand and manage the factors that contribute to unsafe acts. We hope this report makes a contribution towards that goal.

Tara O'Toole, M.D., M.P.H.
Assistant Secretary
Environment, Safety and Health

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Introduction

Vision

The new look to the cover of this report is intended to invite you to look inside. There are new data and analysis that demonstrate how DOE is doing, but also raise questions and are meant to stimulate your own analysis of operating data. In addition, we have organized the indicators into 4 groups: accidents/events, precursors, ES&H management, and hazards. The preponderance of indicators in the first category (accidents/events) and the lack of indicators in the remaining 3 categories reflect a need to rethink what we measure.

Assessment

Although the "right" set of performance indicators for DOE is still evolving, we are able to see some trends in the data:

- For the first time in six years, average radiation dose per person is increasing. Our analysts attribute a good portion of this increase in 1995 to increased decontamination and decommissioning work. (See PI-11)
- Electrical Safety events continue to rise. Electrical safety is a primary contributor to the more than 30% increase in near misses in the most recent quarter (96Q3). (See PI-13 and PI-03)
- Occupational safety and health measures such as lost workday case rate are relatively flat and well below private sector averages. Fortune 500 companies such as DuPont and the chemical industry continue, however, to significantly out-perform DOE and can serve as benchmarks for which DOE could aim. (See PI-01)
- The occupational safety and health cost index continues a steady decrease. Our analysts feel this may reflect increased attention to management of lost workday cases, including making changes in contractor case management programs that stress bringing the injured worker back to work as soon as possible following an injury. (See PI-02)
- Radiation dose to the public has dramatically decreased (by 38%) over the past two years. The 21% reduction from 1994 to 1995 reflects lower levels of operations at Lawrence Livermore and operational changes at Oak Ridge and Savannah River. It should be noted that these doses are not significant when compared to natural background doses received by the same population. (See PI-10)
- The number of reportable releases to the environment has steadily decreased since 1993. Two-thirds of the net decrease between 1993 and 1996 can be attributed to Rocky Flats, Savannah River and Lawrence Livermore. (See PI-07).

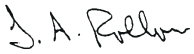
New in this Report

Reflecting our commitment to make this a living document and our drive for better indicators, several changes have been made. We have added 4 new indicators in this report: electrical safety, transportation safety, industrial operations, and plutonium stabilization. Four indicators were dropped because they either did not reveal significant information, or lacked good data.

We are still striving to develop a set of indicators that help to answer the question "How is DOE doing?" Special emphasis is being placed on indicators that demonstrate DOE's progress in reducing hazards, such as the plutonium stabilization indicator.

How You Can Participate

Although the Office of Environment, Safety and Health publishes this report, we consider it a DOE corporate document. We are constantly looking for feedback. As we go to press with this report, EM and EH are sponsoring a workshop on corporate ES&H performance indicators. In addition, we are continuously looking for analytical input, analyses that you have done at your site or in your program that might shed light on ES&H performance. We are also looking for people to detail to our office in Germantown, either to share their experience and expertise with us, or as a developmental assignment. Finally, please fill out the survey form at the end of this report.



Tom Rollow, P.E.
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Contact for Additional Information

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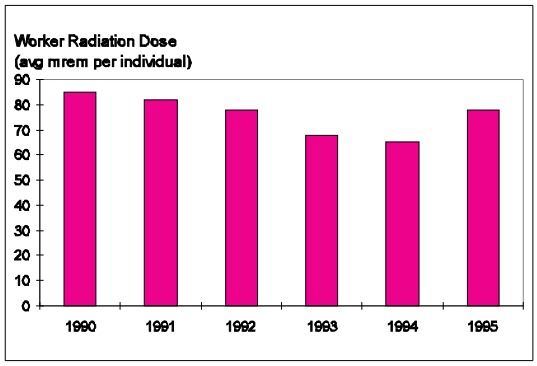
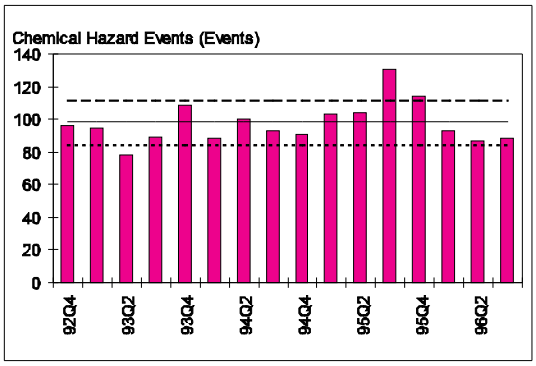
Management Summary

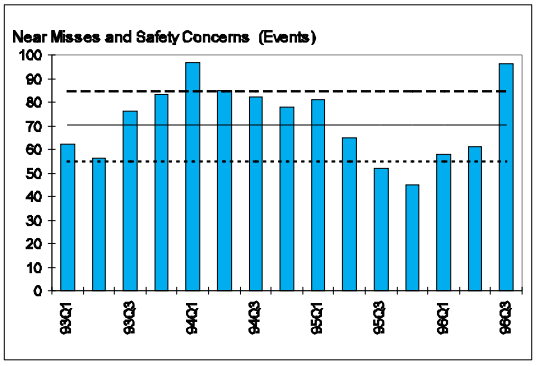
Six of the DOE Environment, Safety and Health Performance Indicators were selected this quarter to highlight below. Lost Workday Case Rate and Reportable Occurrences of Releases to the Environment are included in the Secretary of Energy's Key Indicators. DOE workers, contractors, and subcontractors are included in data obtained from Occurrence Reports. Federal workers have been excluded from the data obtained from the Computerized Accident/Incident Reporting System. The horizontal lines on the graphs represent the historical baseline ±1 standard deviation. Quarterly data is presented as calendar quarters. Trends are identified based on a statistical analysis of the data. A detailed discussion of the method (Multinomial Likelihood Ratio Test, MLRT) is provided in the Glossary section of this report.



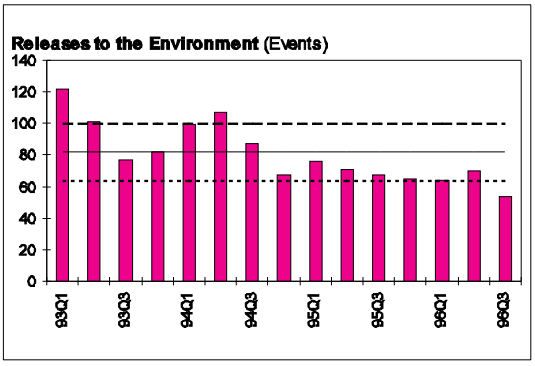
The average measurable dose to DOE workers, determined by dividing the collective total effective dose equivalent (TEDE) by the number of individuals with measurable dose.



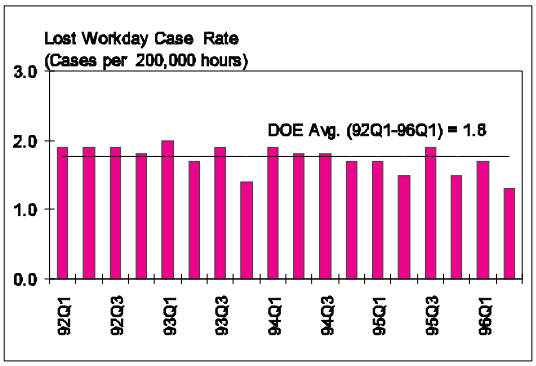
Number of events reportable under DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information*, that are gathered by a word search for specific chemical names.



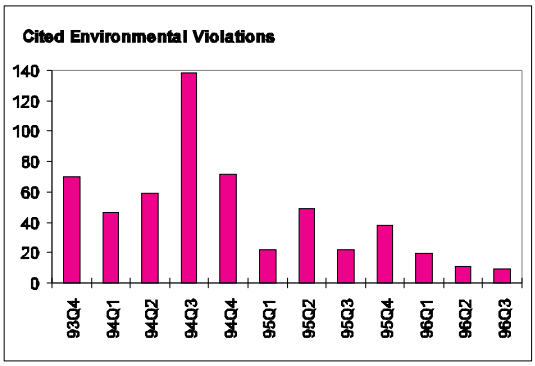
Number of events related to near misses or safety concerns reportable under DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information.*



Number of releases of radionuclides or hazardous substances or regulated pollutants that are reportable to federal, state, or local agencies.



A lost workday case is a work-related injury or illness that involves days away from work or days of restricted work activity, or both. Lost Workday Case (LWC) Rate is the number of lost workday cases per 200,000 hours worked.



Number of environmental violations cited by regulators in enforcement actions at DOE facilities.

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List of Performance Indicators

The performance indicators have been re-organized into four major categories. The numbers correspond to the section numbers used in this report. Indicators appearing for the first time in this report are designated below as "[new]".

1. Accidents/Events that have already happened

Injuries, fatalities, releases, uptakes, etc.

1. Lost Workday Case Rate
2. Occupational Safety and Health Cost Index
3. Electrical Safety [new]
4. Industrial Operations Safety [new]
5. Transportation Safety [new]
6. Chemical Hazard Events
7. Reportable Occurrences of Releases to the Environment
8. Cited Environmental Violations/Fines
9. Environmental Permit Exceedances
10. Radiation Dose to the Public
11. Worker Radiation Dose
12. Radiological Events

2. Precursors to accidents and near misses

Events which resulted in significant reduction of barriers that are depended upon for safety.

13. Near Misses and Safety Concerns
14. Inadequate Procedures/Procedures Not Followed
15. Safety System Actuations
16. Safety Equipment Degradation

3. ES&H Management

Includes work planning, training, manager and worker involvement, and regulatory compliance.

17. Environmental Compliance Milestones Met
18. Open DNFSB Recommendations

4. Hazards level of material at risk

Working with the program offices and sites, we hope to show how DOE is reducing hazards and vulnerabilities.

19. Spent Nuclear Fuel and Plutonium Vulnerabilities Resolved
20. Plutonium Stabilization [new]
21. Toxic Chemical Releases
22. Pollution Prevention

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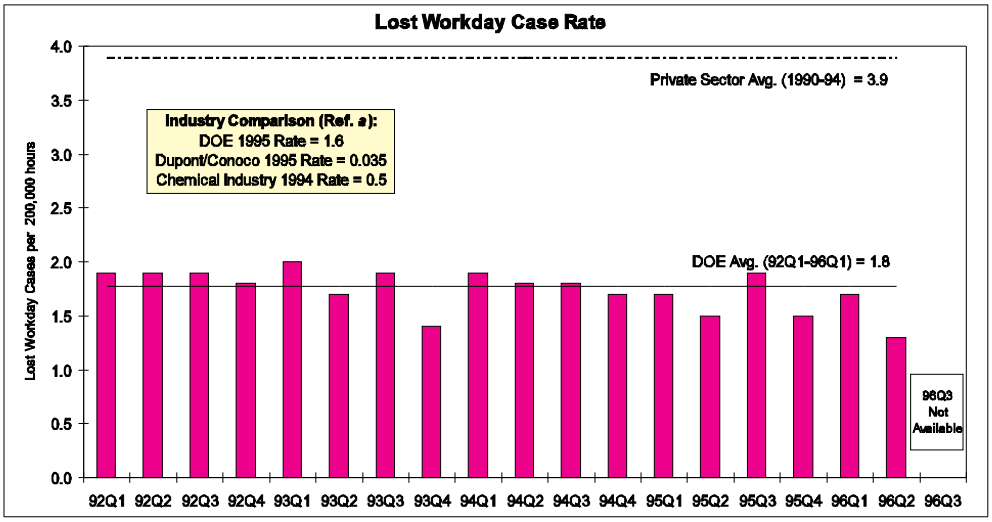
Indicator

1. Lost Workday Case Rate

Definition

A lost workday case is a work-related injury or illness that involves days away from work or days of restricted work activity, or both.

Lost Workday Case (LWC) rate is the number of lost workday cases per 200,000 hours worked.



Source: DOE Data - Computerized Accident/Incident Reporting System;
Private Sector Data - Department of Labor, Bureau of Labor Statistics.

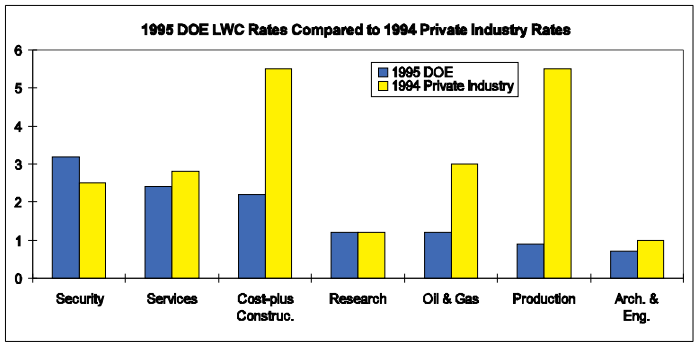
Key Observations

- LWC rates for all quarters from 94Q4 through 96Q2, except 95Q3, fell below the average (92Q1-96Q1) of 1.8 cases per 200,000 hours worked. The LWC rate for the first half of 1996, 1.5 cases per 200,000 hours worked, was 17% lower than the average.

Additional Analysis

- A total of 5,248 injury or illness cases have been reported by DOE contractors (as of September 1996) for 1995. 45.26% (2,375) of this total resulted in a lost workday case. There were 56,698 lost workdays for the 12-month period. In the first half of 1996, 43.91% (984) of total injuries/illnesses (2241) resulted in a lost workday case, and there were 17,469 lost workdays for the 6-month period. The average number of lost workdays per lost workday case was 23.9 in 1995. This ratio has steadily declined since 1991, when it was 31.4. The estimated ratio for the first half of 1996 is 17.8 days lost per lost workday case. 1996 estimates are expected to increase as late and revised data are reported.
- For DOE contractors in 1995, the average number of lost workdays per lost workday case was highest in security and cost-plus construction, where days lost per lost workday case was 29.6 and 27.5, respectively.

- Very general rate comparisons for some operation types can be made to the Department of Labor, Bureau of Labor Statistics (BLS) private industry classifications. The work performed by contractors for DOE falls into several industry classifications, including general building construction, manufacturing of chemicals and allied products, oil and gas extraction, research, security, and sanitary services. The graph shows a comparison of 1995 DOE LWC rates with 1994 private industry rates (the most recent BLS survey).



- Comparisons can be made to industries representing similar functions to DOE. For example, in 1995, the DOE LWC rate was 1.6, while the 1995 LWC rate for DuPont and its energy subsidiary, Conoco, was 0.035. In 1994, the chemical industry LWC rate was approximately 0.5. [a]

Other Information on Occupational Illnesses and Injuries

- Total Recordable Case (TRC) rates for all quarters from 94Q4 through 96Q2, except 95Q3, fell below the average (92Q1-96Q1) of 3.9 cases per 200,000 hours worked. The TRC rate for the first half of 1996, 3.4 cases per 200,000 hours worked, was 13% lower than the average.
- The Lost Workday Incidence rate (LWD) for the first half of 1996 was 26.5 lost workdays per 200,000 hours worked, 47% lower than the average (92Q1-96Q1) of 50.0 lost workdays per 200,000 hours worked. Revisions and late reporting are expected to result in increases in 1996 LWD estimates.

Reference

[a] *Safety, Health and the Environment 1995 Progress Report*, E.I. du Pont de Nemours and Company.

Indicator

2. Occupational Safety and Health Cost Index

Definition

In general terms, the DOE Occupational Safety and Health Cost Index represents the amount of money lost to injuries/illnesses for every hour worked by the total workforce. The Index is a coefficient calculated from the direct and indirect dollar costs of injuries. It is not a direct dollar value and is not commonly used in private industry. DOE sites use this index to measure their progress in worker safety and health. The index is computed as follows:

$$\text{Cost Index} = 100[(1{,}000{,}000)D + (500{,}000)T + (2{,}000)LWC + (1{,}000)WDL + (400)WDLR + (2{,}000)NFC] / HRS$$

where

D = the number of deaths,

T = the number of permanent transfers or terminations due to occupational illness or injury,

LWC = the number of lost workday cases,

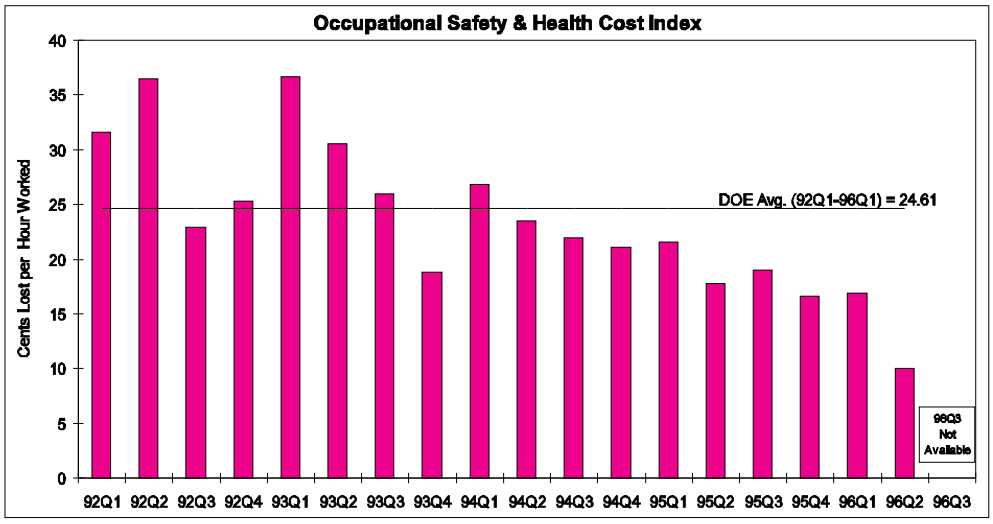
WDL = the number of days away from work,

WDLR = the number of restricted workdays,

NFC = the number of non-fatal cases without days away from work or restricted workdays, and

HRS = the total hours worked.

The coefficients are weighting factors which were derived from a study of the direct and indirect dollar costs of injuries.



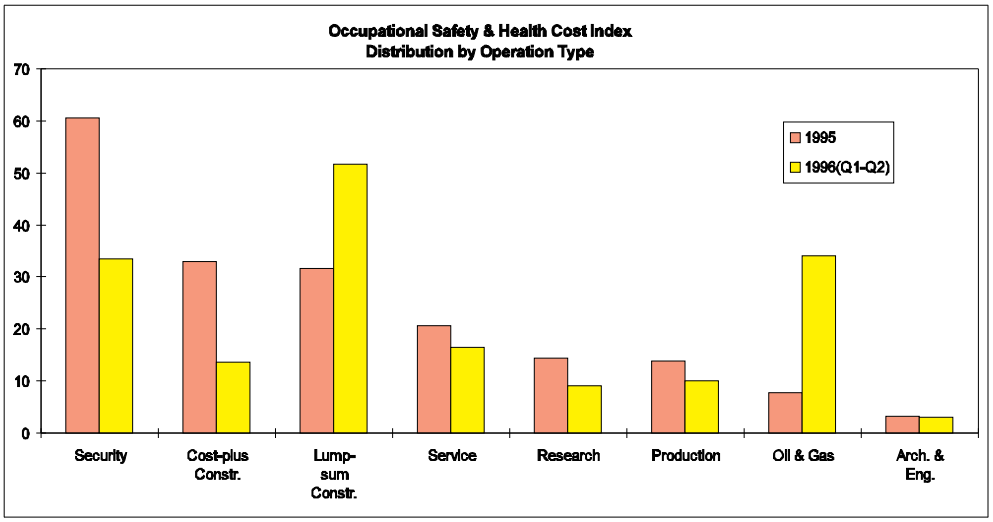
Source: Computerized Accident/Incident Reporting System

Key Observations

- The Cost Index for each quarter since 94Q2 fell below the average (92Q1-96Q1) of 24.61. Lost workday cases and days-away-from-work cases have decreased since 1991 and days of restricted work activity have increased slightly. This may reflect field initiatives, such as, increased focus on reducing days away from work

due to injuries. Revisions and late reporting are expected to result in increases in 1996 estimates.

- The cumulative Cost Index for DOE contractors has decreased each year since 1991. However, the index for each operation type has not been consistently declining. The highest Cost Index for 1995 was for security operations. Current 1996 estimates indicate the highest index is for lump sum construction. In 1995 and 1996, both of these operation types experienced fatalities, which has the highest weighting factor applied in the Cost Index calculation. The graph shows the Cost Index distributed by Operation Type for 1995 and the first half of 1996.



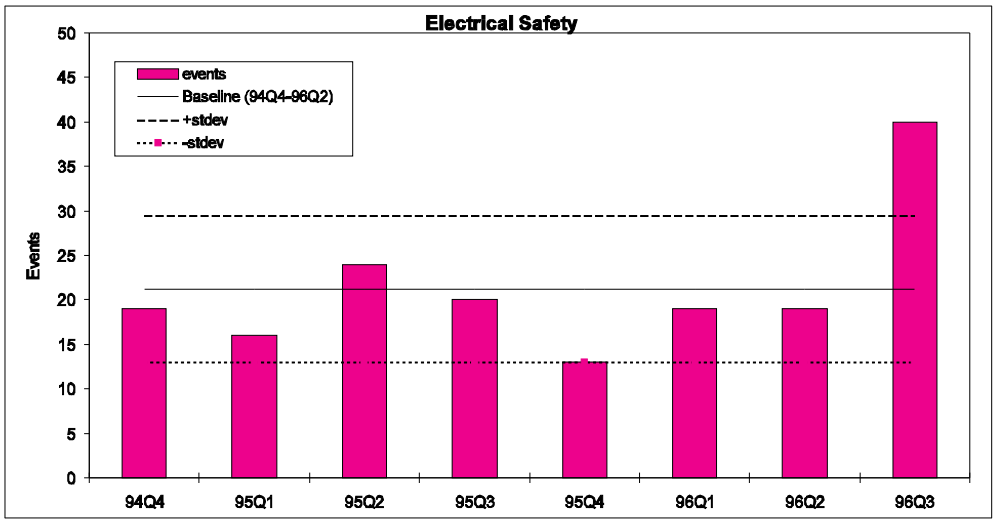
Indicator

3. Electrical Safety

Definition

The number of operations-related events involving worker contact with or the potential for contact with electrically energized equipment reportable under DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information,* as determined by a review of all occurrence reports by Department analysts.

The electrical safety binning criteria has undergone some transition during CY-1996, which has resulted in a varying number of electrical safety near misses being included in the data. In the future DOE will refine the criteria to more closely reflect electrical hazards.



Source: Engineer Review of Occurrence Reports.

Key Observations

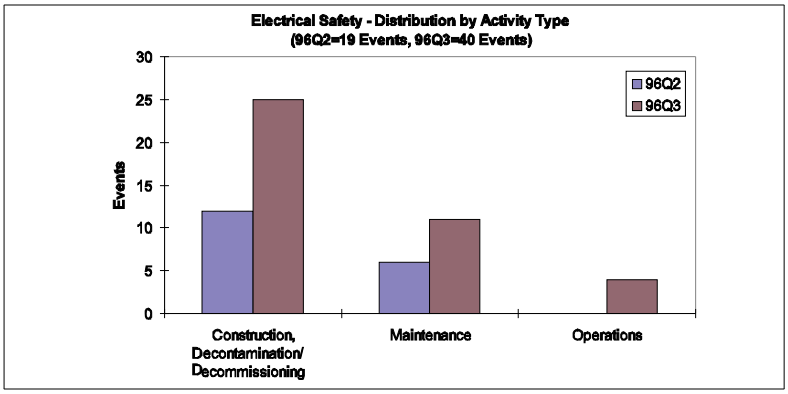
- Since 95Q4, DOE has experienced an increase in the number of electrical safety events. This may be due to a few severe incidents which may have heightened awareness of reporting these types of events. As a result, the number of reportable events in 96Q3 is nearly twice the number of events reported in any of the previous 7 quarters.
- Of the 58 electrical safety events reported during 96Q2 and 96Q3, only 14 involved a person actually sustaining a shock. 2 of the 14 that received a shock were working on ladders; one was knocked off and sustained injury from the fall. The remaining 44 involved situations where a serious potential for shock existed.
  - Of the 14 events involving a shock, 5 required immediate medical care and 1 required extended hospitalization and surgery.

Additional Analysis

- During 96Q2 and 96Q3, 76% of the electrical safety events were in some way caused or compounded by human error (either the root, direct, or a contributing cause was attributed to personnel error).
- Of the 58 electrical safety events reported in 96Q2 and 96Q3, 15 were related to violation of lockout/tagout procedures.
- The severing of electrical lines by excavation and drilling operations accounted for 17 of the 58 electrical safety events reported in 96Q2 and 96Q3.

Distribution by Activity

- The 58 events in 96Q2 and 96Q3 fall into 3 major activity categories: construction or decontamination/decommissioning activities (37), maintenance activities (17), and routine operations (4).



Distribution by Location

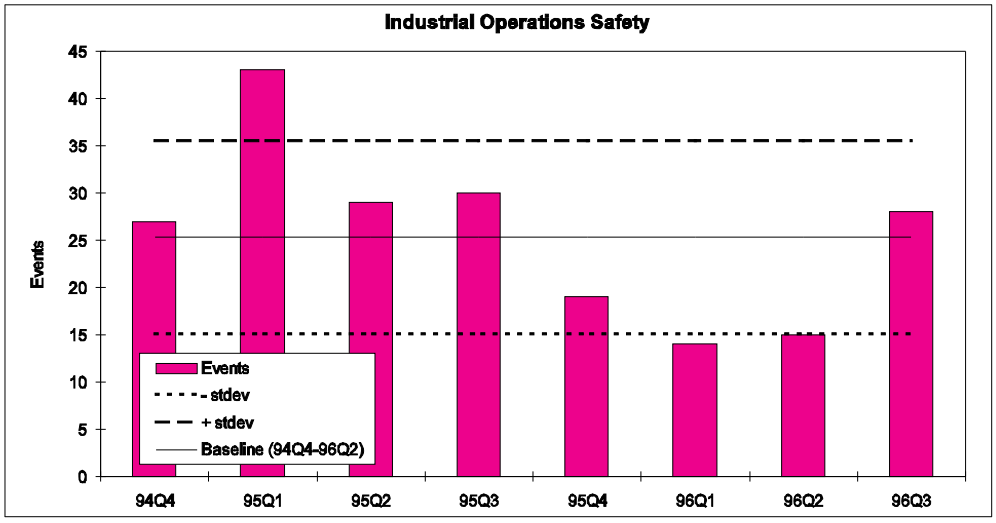
- No single location dominates the 96Q2 data. Los Alamos (7) and Idaho (6) contributed 13 of the 40 reported events in 96Q3.

Indicator

4. Industrial Operations Safety

Definition

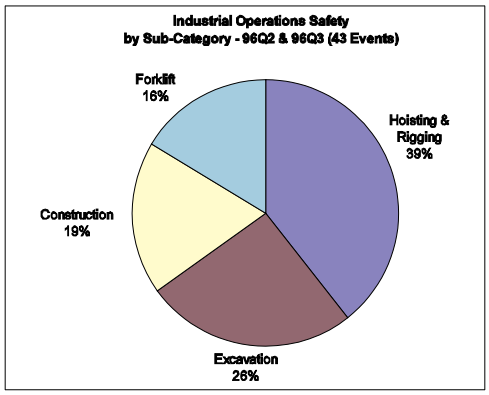
The number of operations-related events involving construction equipment, forklift operations, hoisting, rigging, or excavation reportable under DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information,* as determined by a review of all departmental occurrence reports by Department analysts.



Source: Engineer Review of Occurrence Reports by Defense Programs.

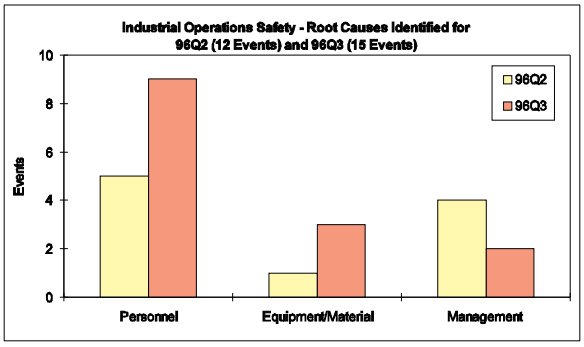
Key Observations

- 4 of the 43 events during 96Q2 and 96Q3 resulted in injuries.
- Although forklift operations contributed only 16% of the industrial operations events, they resulted in 3 of the 4 injuries over the 2nd and 3rd quarters of 1996.



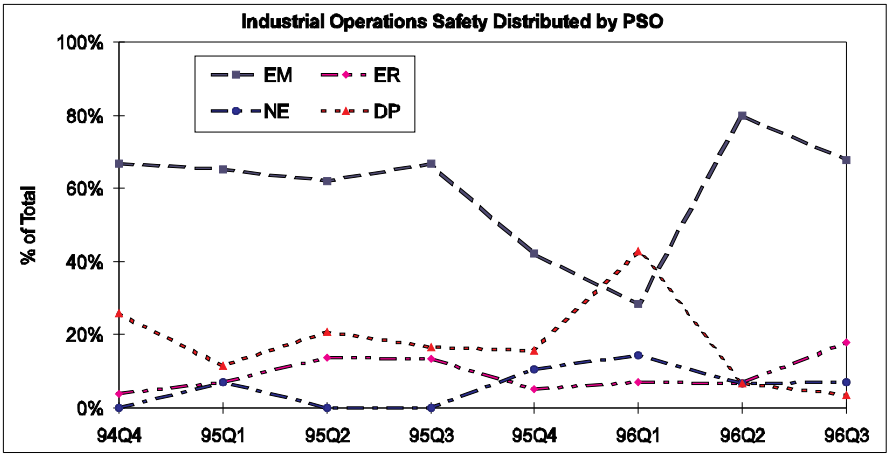
Additional Analysis

Root Causes: In 96Q2 and 96Q3, 14 out of 27 events (52%) where any cause had been determined involved a personnel error, while 6 (22%) involved management problems. The graph depicts the distribution by root cause.



Distribution by Location: The increase in events at Richland from 96Q2 to 96Q3 was the primary contributor to the increase observed for all of DOE industrial operations events over the same period. DOE Richland Operations Office staff stated that they were aware of the situation and were investigating possible causes. In the case of Savannah River, increased use of subcontractors over the reporting period was cited as a possible contributing factor.

Distribution by PSO: As is the case with many of the performance indicators in this report, among all of the Program Secretarial Offices (PSOs), Environmental Management (EM) has been the leading contributor of industrial operations events for 96Q2 and 96Q3 with 13 and 19 events respectively. The next leading contributors were Energy Research (ER) and Nuclear Energy (NE). Defense Programs' (DP) contribution is much lower than might be expected based upon the distribution of hours worked.

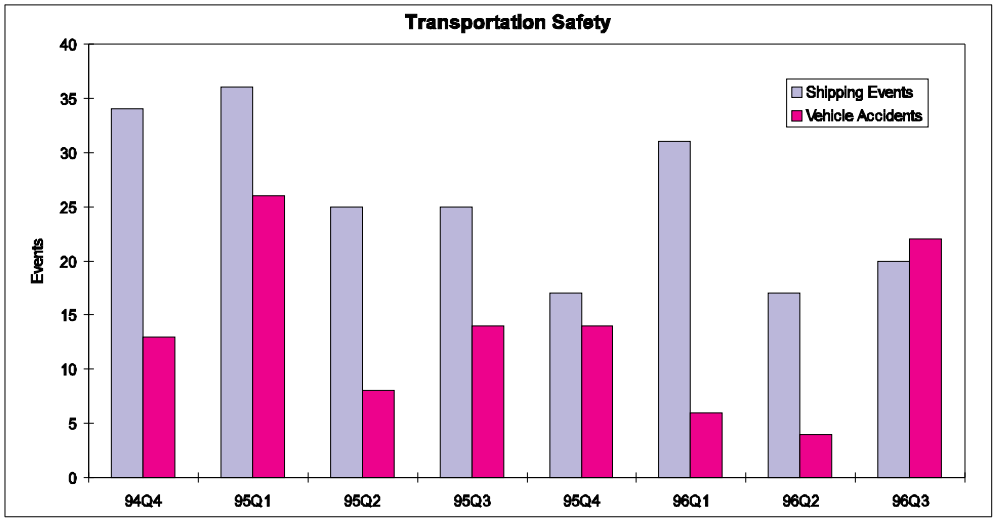


Indicator

5. Transportation Safety

Definition

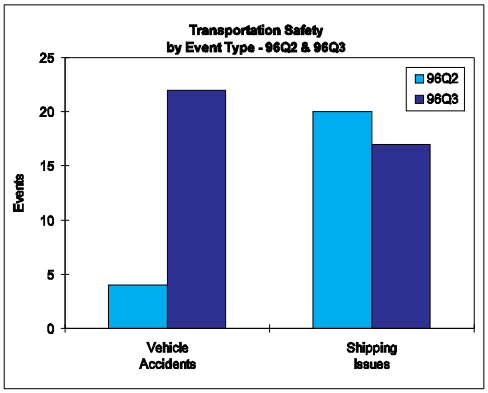
The number of transportation-related events involving shipping issues (reported as a transportation event) and/or vehicular accidents (reported as a personnel safety event) reportable under DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information,* as determined by a review of all departmental occurrence reports by Department analysts.



Source: Engineer Review of Occurrence Reports by Defense Programs.

Key Observations

- For 96Q2 and 96Q3, the number of shipping-related issues has remained relatively stable while the rise in the total number of transportation safety events in 96Q3 can be attributed to a significant increase in the number of vehicle accidents.



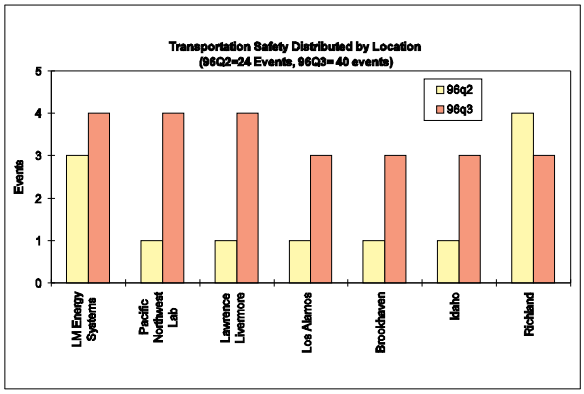
- The only transportation safety-related fatality involved a Los Alamos employee traveling on business, who succumbed to an aneurysm which led to a collision with another vehicle.

Additional Analysis

- Comparing the number of transportation safety events that occurred on-site within the complex versus those that occurred off-site, the number of off-site events has remained stable from 96Q2 to 96Q3 with 9 and 10 events, respectively. There was, however, a large change in the number of on-site events over the same period (96Q2=15, 96Q3=29).

Distribution by Location

- For 96Q2 and 96Q3 combined, Lockheed Martin Energy Systems and Richland were the leading contributors with 7 events each; the types of events were split between vehicle accidents and shipping issues. However, low numbers are involved at all locations, and no location appears dominant.



Vehicle Accidents

- All of the 4 vehicle accidents occurring in 96Q2 resulted in some form of injury. In 1 case, a person suffered a fractured vertebra. The remaining 3 cases resulted in minor injuries. In 96Q3, however, one of the events involved a fatality. Only 10 other injuries were reported as a result of the total 22 accidents reported during the quarter, and all of these were considered minor.
- The tangible costs of the 4 vehicle accidents in 96Q2 amounted to $32,000. The costs involved with the 22 events in 96Q3 were higher than 96Q2 involving a loss of $50,116.
- The vehicle accidents are evenly distributed among several locations. Low vehicle accident numbers are involved at all locations, and no location appears dominant.

Shipping Issues

- Pacific Northwest National Laboratory (PNNL) was the leading contributor to shipping issues during 96Q2 (1) and 96Q3 (4). Several locations had 4 shipping issues during this period.
- 2 of the PNNL issues involved improper use of a personal vehicle to ship an item, and 2 of the issues involved incomplete shipping papers. The remaining issue involved improper markings on a shipment.
- Low numbers of shipping issues are involved at all locations, and no location appears dominant.

Distribution by Cause

- Half of the transportation safety events assigned a root cause during 96Q2 and 96Q3 have been attributed to personnel errors. Management problems are the second leading root cause. This is consistent with the most recent 1-year period (95Q2-96Q1). In both 96Q2 and 96Q3, the leading personnel error root cause subcategory was inattention to detail.

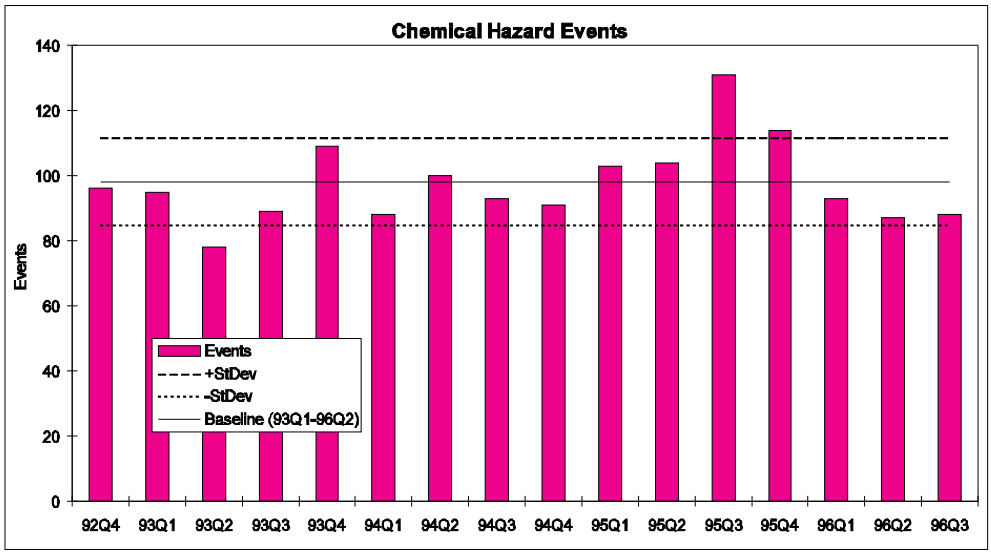
Indicator

6. Chemical Hazard Events

Definition

The number of events reportable under DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information*, that are gathered by a word search for specific chemical names. The selected events are reviewed and screened for conditions meeting one of the following categories:

- Class 1 - An injury or exposure requiring hospital treatment or confirmed, severe environmental effect.
- Class 2 - Minor injury (first aid) or exposure, or minor environmental damage.
- Class 3 - Potential precursors to the occurrences in Class 1 or 2.
- Class 4 - Minor occurrences such as leaks, spills, or releases which are significant by the frequency, but not by the consequences.



Source: Chemical Safety Concerns: A Quarterly Review of ORPS April –June 1996. U.S. Department of Energy, Office of Field Support, EH-53.

Key Observations

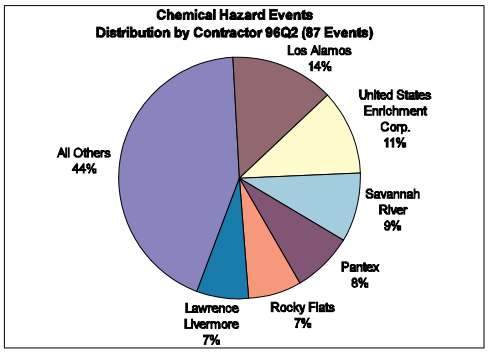
- The number of chemical hazard events has decreased each quarter since 95Q3. However, over the 15 quarter period displayed, there is an increasing trend in the total number of chemical hazard events is observed based on MLRT analysis.
- Class 3 and 4 (less severe) events continue to comprise 88% of the overall chemical hazard events identified over the last 15 quarters. An increasing trend in the number of Class 3 and 4 events identified over this period is observed based on MLRT analysis. During the last 15 quarters, there is no detectable trend in the number of Class 1 and 2 events.

Additional Analysis

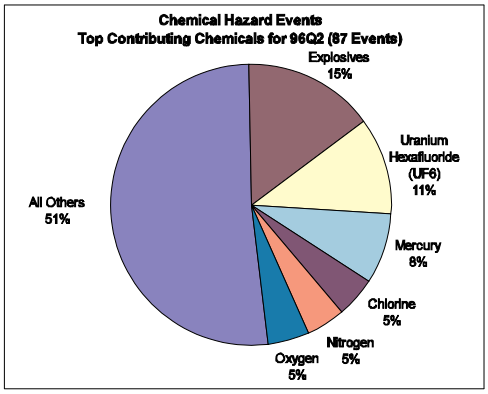
Analysis of chemical hazard events focuses on 2nd quarter 1996, since this is the most recent analysis available at this time from the Office of Field Support.

Characterization of Chemical Hazard Events: During 96Q2, no Class 1 events and 8 Class 2 events were identified. Of the 8 events, there were 3 chemical reactions/incompatibilities, 2 workplace releases, 1 case of inadequate work control, 1 explosion, and 1 pressurized chemical spray. The Class 2 events each occurred at a different Operations Office.

Distribution by Location: The major contributors in 96Q2 are identified in the chart. While the largest percentage of events (29%) occurred at Albuquerque Operations, none were Class 1 or 2 events.

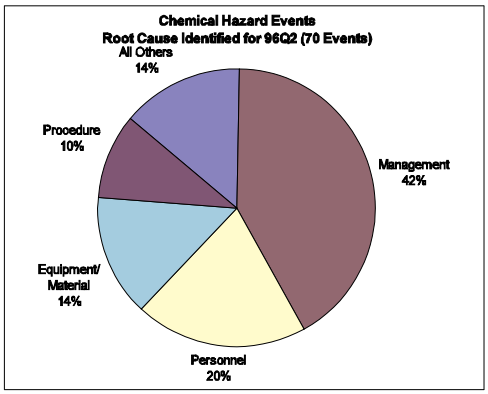


Distribution by Chemicals Involved



- The top contributing chemicals during 96Q2 are identified in the chart. The Class 2 events involved sulfuric acid, nitric acid, sodium hydroxide, and sodium metal/hydrogen. There were no Class 1 events.
- UF6 and hydrogen were the leading contributors to the chemical hazard total for the previous 9 quarters. During 96Q2, 1 event involved hydrogen and no Class 1 or 2 events involved UF6. Uranium hexafluoride (UF6) was involved in only 11% of the total chemical hazard conditions identified during 96Q1 and 96Q2, down from over 30% of the total during each of the previous 2 quarters. This decrease corresponds with implementation of an agreement that USEC no longer is required to report off-normal events to DOE. The number of chemical hazard unusual occurrences at USEC has remained relatively constant.

Root Causes: The root cause distribution for 96Q2 is shown in the chart. This is the first quarter out of the last 6 quarters that equipment/material problems were not one of the top 2 root causes.

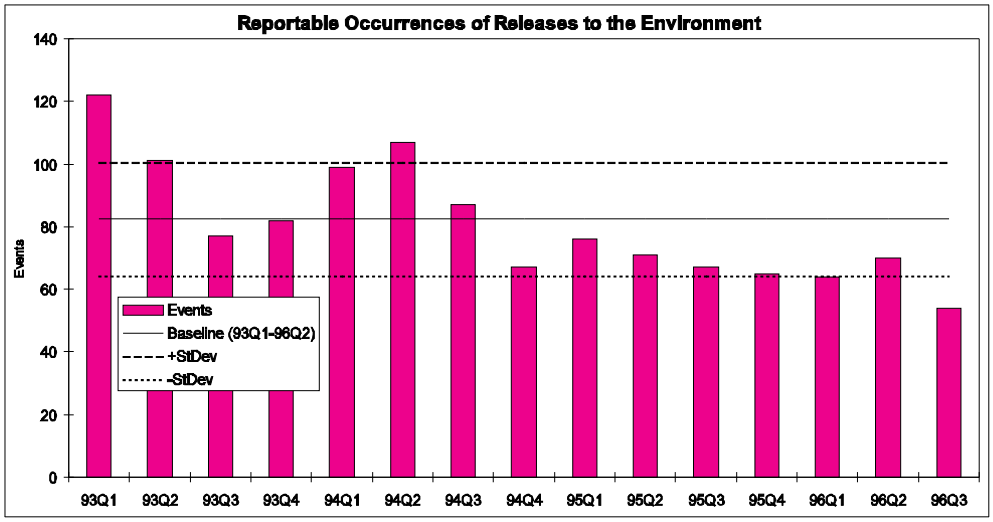


Indicator

7. Reportable Occurrences of Releases to the Environment

Definition

Number of releases of radionuclides, hazardous substances, or regulated pollutants that are reportable to federal, state, or local agencies.



Source: Engineer Review of Occurrence Reports.

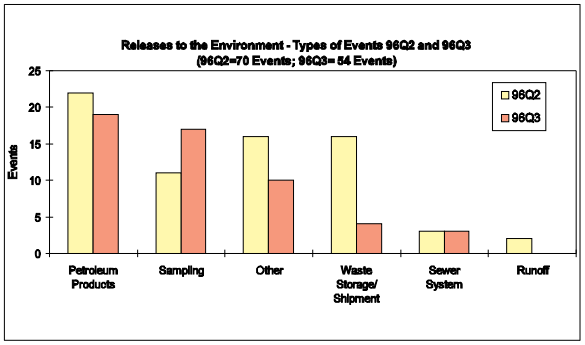
Key Observations

- Reportable release incidents show a decreasing trend over the last 15 quarters based on MLRT analysis.
- DOE annual totals have steadily decreased since 1993 (CY93=382, CY94=360, CY95=281, CY96=246 estimated assuming 96Q4 releases will be equal to the average of the first 3 quarters of 1996). 68% of the net decrease between 1993 and 1996 can be attributed to Rocky Flats, Savannah River and Lawrence Livermore. About 75% of the decrease between 1993 and 1996 can be associated with DP facilities; the remainder is associated with EM facilities.
- Unlike the other indicators based on occurrence reports, releases to the environment are heavily influenced by the wide variations in reporting requirements from state to state (that is, similar events at two different sites may be reportable in one state but not in the other). It is important to take this into account when making judgments about the release data.

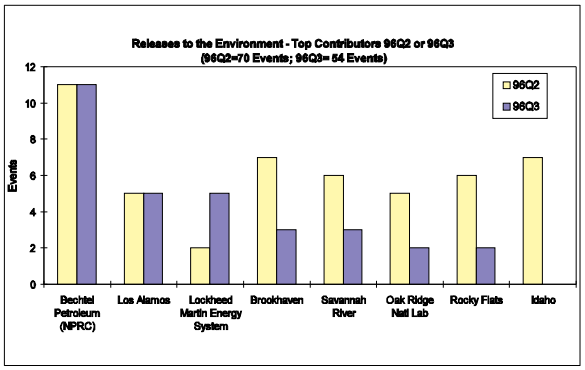
Additional Analysis

- The increase in the DOE total between 96Q1 and 96Q2 (from 64 to 70 events) can be attributed to an increase in petroleum product spills/leaks (from 11 to 22 events). The decrease between 96Q2 and 96Q3 (from 70 to 54 events) is primarily due to a corresponding decrease in waste shipping and storage events (from 16 to 4 events).
- One release event in 96Q3 involved radioactive material; this was also the only event classified as an emergency and involved activation of the Emergency Operations Center after discovery of significant contamination during excavation of a trench at Rocky Flats. All other events in 96Q2 and 96Q3 involved hazardous materials; 11% of the events for these two quarters were classified as unusual events, 89% as off-normal events.

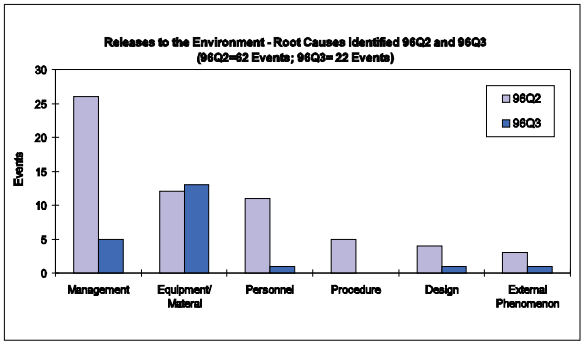
- The types of release events for 96Q2 and 96Q3 are shown in the graph. The category "other" includes events such as broken pipes, missed or incorrect surveillances, training, brine and other chemical releases, and work without proper permits.



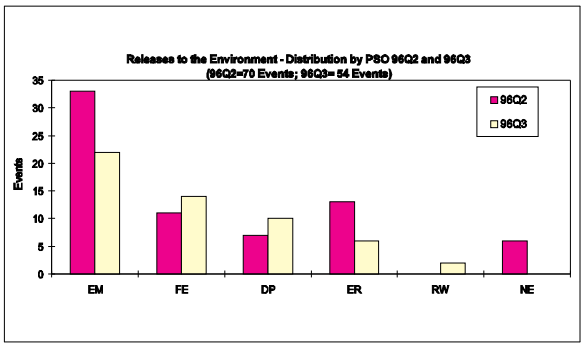
Distribution by Location: The 8 locations that contributed at least 5 events in 96Q2 or 96Q3 are shown in the graph. No one site dominates this performance indicator. Meaningful trends over time are difficult to identify due to the relatively low number of events for individual locations.



Root Causes: The leading root causes of release events for 96Q2 and 96Q3 are shown in the graph. Historically, the leading root cause for releases has been management problems, followed by equipment/material problems and personnel problems. Root causes were identified for 89% of the 96Q2 release events and 41% of the 96Q3 release events.



Distribution by Program Secretarial Office (PSO): The distribution of release events by PSO for 96Q2 and 96Q3 is shown in the graph. The contribution by Environmental Management (EM) facilities (about 40-50%) is proportional to EM's contribution to the total number of people (FTEs), i.e., EM represents about 44% of the FTEs for organizations which submit occurrence reports. Since 93Q1, decreasing trends have been observed for EM and DP facilities based on MLRT analysis.

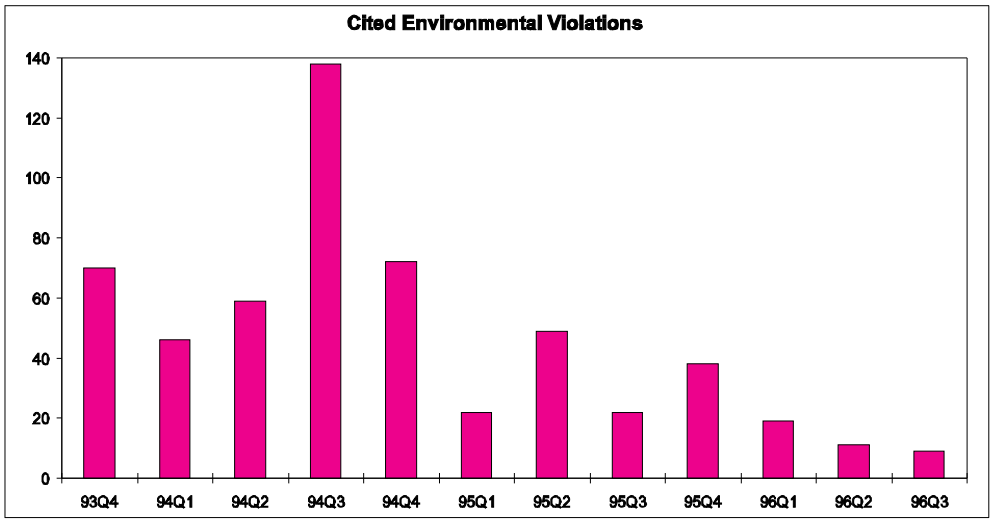


Indicator

8. Cited Environmental Violations/Fines

Definition

Number of environmental violations cited in enforcement actions or fines and penalties assessed by regulators at DOE facilities.



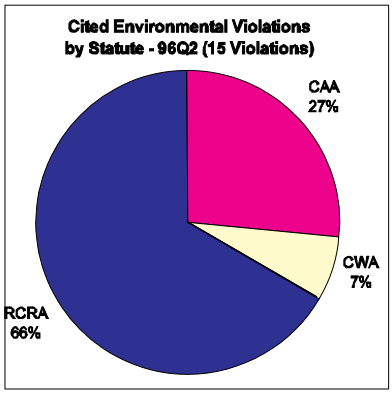
Source: EH-41 Compliance Database.

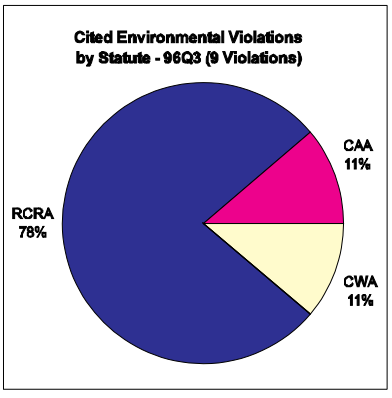
Key Observations

- The number of environmental violations cited at DOE facilities continues to decline. In the past 2 quarters the preponderance of violations cited have been under the Resource Conservation and Recovery Act (RCRA).
- The number of fines assessed and the amount of fines assessed continue at a relatively low level, comparable to the previous several quarters, and significantly below levels in 1994.
- 2 fines of $10,000 or greater were assessed, both under RCRA. In the past 3 years most large fines assessed against DOE sites (9 of 11 fines of $10,000 or greater) have been assessed under RCRA.
- The data remain quite variable from quarter to quarter.

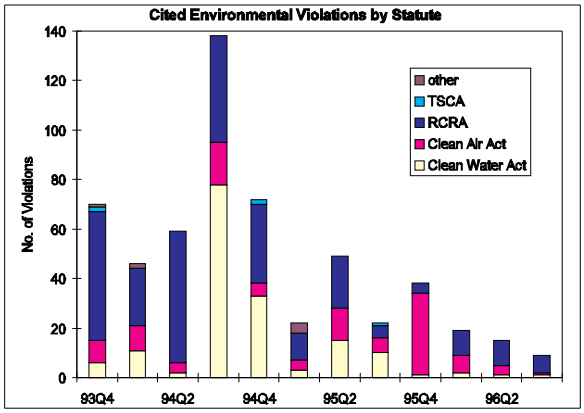
Additional Analysis

Violations by Statute



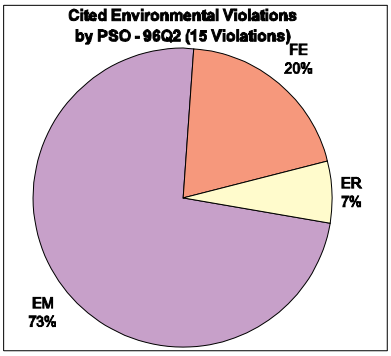


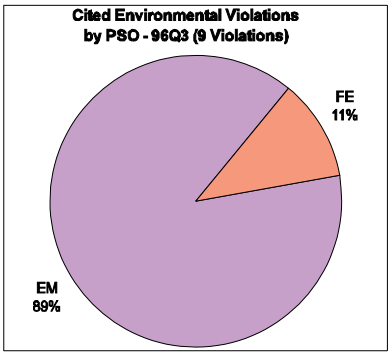
- RCRA accounts for two-thirds to three-fourths of the violations cited in the past 2 quarters, as well as all of the fines assessed. In the previous 10 quarters, RCRA violations only twice exceeded this level.



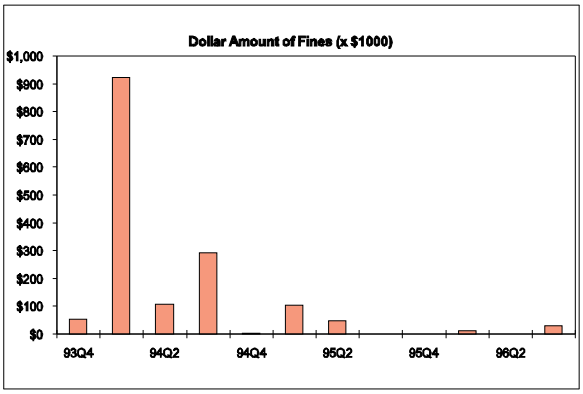
Violations by Program Office

In 96Q3, 5 of EM's 8 violations were RCRA violations cited at Portsmouth.



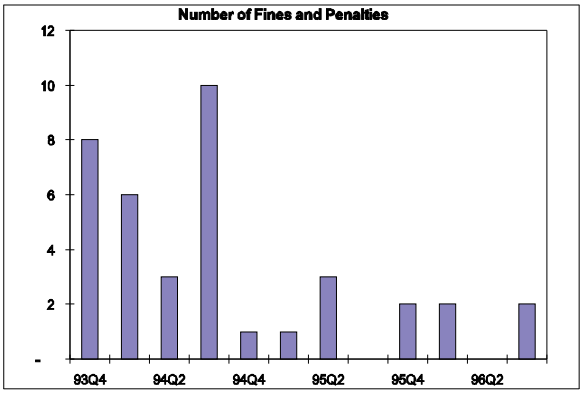


Amount of Fines



Number of Fines

- In the past 3 years most large fines assessed against DOE sites (9 of 11 fines of $10,000 or greater) were assessed under RCRA.
- Because no attempt has been made to normalize data among sites, a site-to-site comparison is neither appropriate, nor attempted, using this indicator.



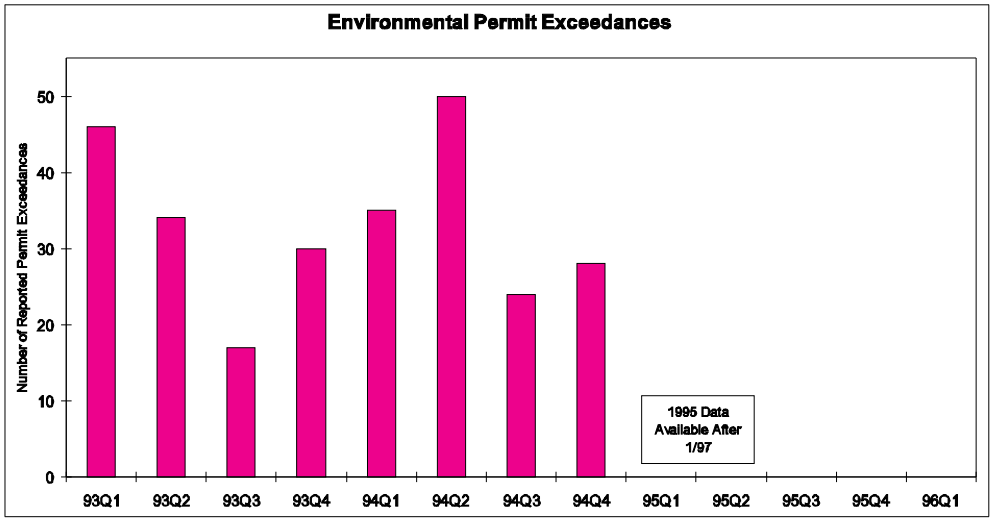
Indicator

9. Environmental Permit Exceedances

Definition

Exceedance of release levels specified in air and water permits during the quarter.

No new data were available for this report.



Source: Annual Site Environmental Reports, additional site data.

Key Observations

- Seasonal effects (precipitation, temperature, sunlight) influence the number of exceedances, particularly in the first 2 quarters of each calendar year.
- Approximately 95% of exceedances over the 2-year period displayed (1993-1994) were due to violations of water discharge permit conditions under the Clean Water Act; 5% were attributed to Clean Air Act permit violations.
- Four facilities (Argonne National Laboratory - East, Los Alamos, Portsmouth, and West Valley) consistently accounted for almost 70% of the total number of exceedances through 94Q4.

Additional Analysis

Characterization by Release Path

- Most exceedances (95%) occurred under National or State Pollutant Discharge Elimination System (NPDES/SPDES) permits mandated by the Clean Water Act to protect surface waters by limiting effluent discharges to receiving streams, reservoirs, ponds, etc. These permits specify discharge standards for various parameters and constituents as well as monitoring and reporting requirements. Industrial and sanitary wastewater discharges as well as stormwater runoff discharges are regulated under NPDES/SPDES permits.
- The other major type of permit violations (5%) occurred under Clean Air Act permits for on-site emission sources from industrial operations, chemical process systems, or waste processing systems that discharge to the ambient air through stacks, ventilators, air ducts, etc. (i.e., Air Quality Permits, etc.).

Distribution by Location

- The 4 major contributors (of the 54 DOE facilities from which the data were compiled) accounted for almost 70% of the total number of permit exceedances across the DOE complex through 94Q4. All 4 of the major contributors routinely discharged into receiving waters from significant ongoing on-site processes, industrial operations, and sanitary wastewater operations, and all were affected by variations in precipitation and storm events. The facilities were, therefore, sensitive to stormwater runoff related exceedances. Some large sites such as Idaho, Hanford, and the Nevada Test Site contributed no permit exceedances because of low annual precipitation and less likelihood of stormwater runoff related exceedances.

Characterization of Permit Exceedances

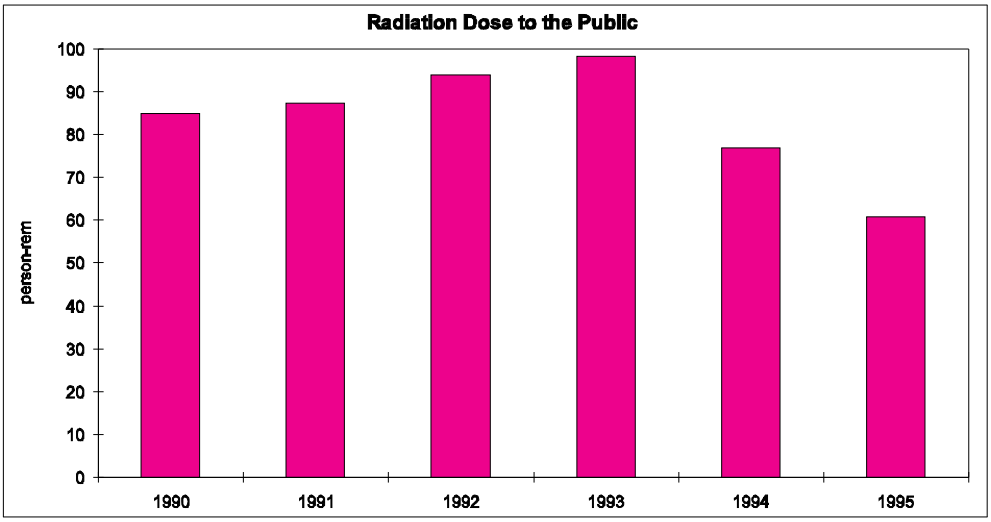
- The number of exceedances is a function of the permit-specific parameters, number of outfalls, reporting frequency requirements, and the timing of the NPDES/SPDES permit renewal. In addition, changes in temperature, sunlight, and increased rainfall events all contribute to permit exceedances of non-toxic parameters such as Biological Oxygen Demand (BOD), pH, and Total Suspended Solids (TSS).
  - Exceedances were significantly more frequent during the first two quarters of the year. This was due primarily to increased precipitation, temperature, sunlight, and biological activity in on-site retention lagoons/ponds at the high-contributing sites, resulting in significant exceedances of the TSS, pH, BOD, and temperature permit parameters at these sites.
  - During 94Q1, West Valley renewed their SPDES permit which required additional chemical monitoring requirements and more stringent effluent limitations. This, along with the increased precipitation and temperature, resulted in a higher number of exceedances in 94Q2. This appears to be true of other sites as well.
  - Portsmouth contributed 13 exceedances in 94Q2 with most exceedances attributed to TSS, pH, and daily temperature violations due to precipitation and temperature influences.

Indicator

10. Radiation Dose to the Public

Definition

Total collective radiation dose (person-rem) to the public within 50 miles of DOE facilities due to radionuclide airborne releases. ("Collective radiation dose" is the sum of the effective dose equivalent to all off-site people within a 50-mile radius of a DOE facility over a calendar year.)



Source: Annual reports to EPA; EH-41 preliminary tabulation.

Key Observations

- Total collective radiation dose to the public from DOE sources is very low compared to the public dose from natural background radiation. The total collective radiation dose to the public around DOE sites from air releases is one ten-thousandth of the dose received by the same population from natural background radiation.
- Total collective radiation dose to the public in 1995 decreased 21% from the previous year.
- Based on corrected data, total collective radiation dose to the public decreased 22% from 1993 to 1994.
- The decrease in collective radiation dose in 1995 reflects decreases in the dose from Oak Ridge, Lawrence Livermore Site 300, and Savannah River; in 1994 these sites accounted for almost 68% of the dose.

Additional Analysis

- In 1994, Oak Ridge, Lawrence Livermore Site 300, and Savannah River accounted for almost 68% of the total dose.
  - In 1995, the dose from Savannah River was 22% the dose reported in 1994; a decrease of 12.5 person-rem. The reduction was due to operational changes at the Replacement Tritium Facility (RTF). The RTF had decreases in tritium oxide emissions and decreases in tritium processing.
  - In 1995, the dose from Lawrence Livermore Site 300 was 45% the dose reported in 1994; a decrease of 9.3 person-rem. The reduction reflects a lower level of operation at the Building 513 Stabilization Unit.
  - In 1995, the dose from the Oak Ridge Reservation was 63% the dose reported in 1994; a decrease of 7 person-rem. The reduction is due to operational changes at the Y-12 plant.

- While the dose from several other sites increased from 1994 to 1995, there was still a net decrease of 21% below the 1994 population dose.
- An increase of 7.8 person-rem in the calculated dose from Lawrence Berkeley National Laboratory appears to reflect the use of local wind data for 1995 instead of Oakland Airport data as in previous years.

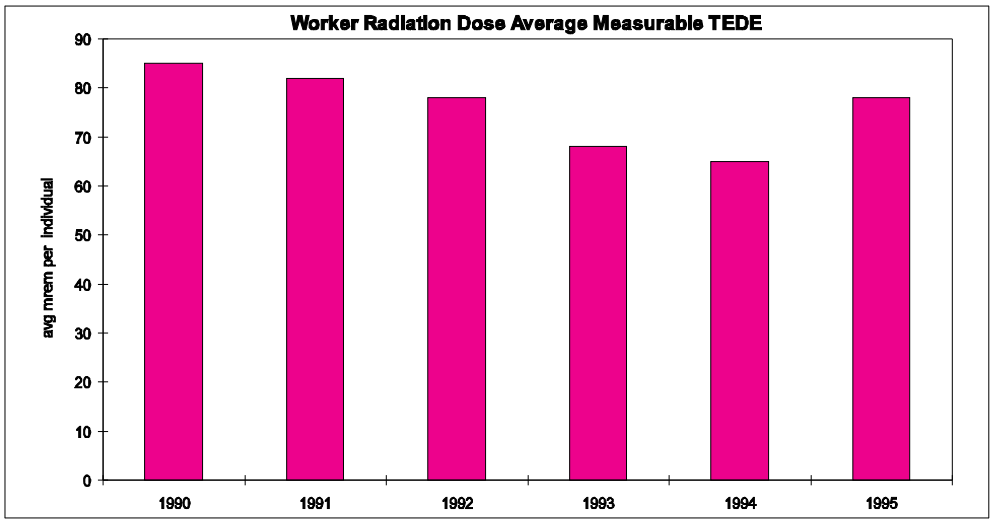
Indicator

11. Worker Radiation Dose

Definition

The average measurable dose to DOE workers, determined by dividing the collective total effective dose equivalent (TEDE) by the number of individuals with measurable dose.

TEDE is determined by combining both internal and external contributions to an individual's occupational exposure. The number of individuals receiving measurable dose is used as an indicator of the exposed workforce size. It includes any individual (federal employees, contractors, subcontractors, and visitors) with reported doses greater than the minimum detectable dose.



Source: DOE/EH-52 and DOE Occupational Radiation Exposure Report 1995, DOE/EH-52, U.S. Department of Energy, December 1996 draft.

Key Observations

- The average TEDE per individual with measurable exposure decreased from 85 mrem in 1990 to 78 mrem in 1995. For comparison, the average exposure for the U.S. population from medical diagnostic x-rays is about 40 mrem.[a]
- For the first time in six years, average radiation dose per person is increasing. A good portion of this increase in 1995 is attributed to increased decontamination and decommissioning work.
- 80% of the collective TEDE is accrued at just six of the highest-dose DOE sites: Savannah River, Rocky Flats, Hanford, Los Alamos, Idaho, and Brookhaven.
- Occupational radiation dose reported by DOE has been impacted over the past 5 years by changes in operational status of DOE facilities, reporting requirements, and radiation protection standards and practices.

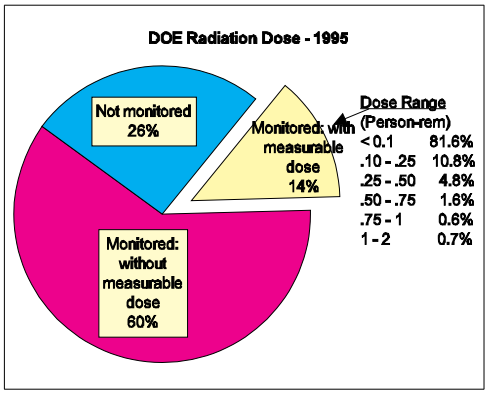
Additional Analysis

Additional information concerning exposure received by individuals associated with DOE activities are included in the DOE Occupational Radiation Exposure Report 1995 (December 1996 draft).

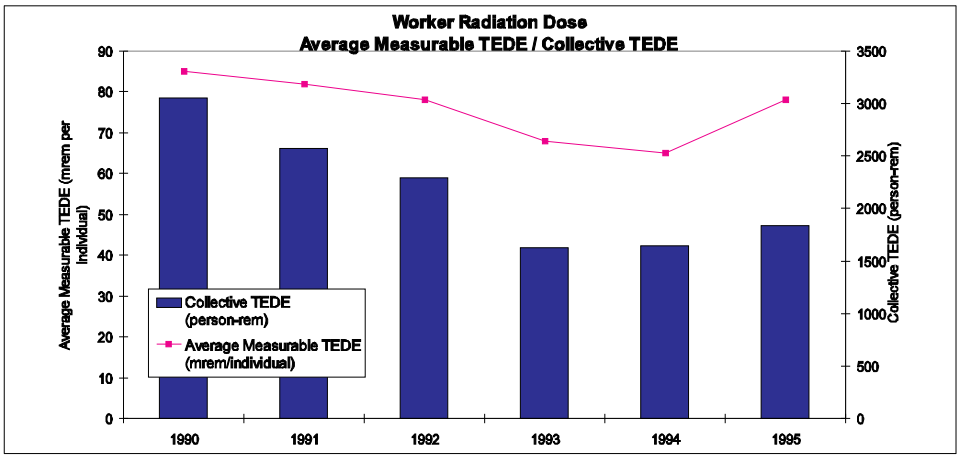
DOE Doses

- In 1995, 74% of the 172,178 DOE workers and contractors were monitored; 19% of those monitored received a measurable dose.

- No individuals exceeded the DOE limit of 5 rem or the administrative control level (ACL) of 2 rem in 1995. 92% of the workers with a measurable dose received a dose of less than 0.25 rem. Doses in excess of the ACL and the DOE TEDE dose limit have decreased over the past 6 years. Most of this decrease is because of the change in methodology for determining internal dose discussed below.



- The collective TEDE (the sum of the TEDE received by all monitored individuals) for 1995 was 1834 person-rem. The graph below indicates the decline in both average dose and collective dose.



Distribution by Site

The six leading contributors to the collective TEDE for 1995 comprised 80% of the total DOE dose. Five of the six sites reported increases which resulted in a 12% increase in the DOE collective dose from 1994 to 1995. The sites provided the following information on activities that contributed to the collective dose for 1995.

- Los Alamos: Most of the 24% increase (from 190 to 235 person-rem) was attributed to increased work on the production of power sources for NASA.
- Brookhaven: Most of the 58% increase (from 92 to 146 person-rem) is attributed to an 82% increase in the days of operation and intensity of the Alternating Gradient Synchrotron accelerator. Increased frequency of maintenance surveys conducted on aging equipment was also a contributing factor.
- Idaho: Most of the 20% increase (from 237 to 284 person-rem) is attributed to increased operations at Idaho Chemical Processing Plant (ICPP). Two key ICPP facilities were deactivated in 1995.
- Rocky Flats: Most of the increase (from 232 to 261 person-rem) is attributed to increased decontamination/decommissioning activities and material stabilization work. Consolidation of special nuclear material and processing of potentially unstable residues for safe storage began in 1995.

- Hanford: Most of the increase (from 215 to 291 person-rem) is attributed to increased use of the tank farm and K Basins associated with nuclear material and facility stabilization.
- Savannah River: The site collective TEDE decreased 19% from 1994 to 1995 (from 315 to 256 person-rem). Operations at the major facilities were about the same in 1995 as in 1994. The Defense Waste Processing Facility (which represented 5% of Savannah River's total in 1994) was restarted near the end of 1995.

Comparison to Other Sources

- As a basis of comparison, the average Occupational Radiation Exposure received by shipyard personnel associated with the Naval nuclear propulsion program was 98 mrem per individuals with measurable dose for 1994 versus 65 mrem for DOE in 1994 and 78 in 1995.[b] Table 1 provides 1995 average occupational exposures for workers with measurable doses for Nuclear Regulatory Commission licensees.

TABLE 1
Comparison to 1995 Average Occupational Exposures for Workers with Measurable Doses[c]

License Category	Average Measurable TEDE per Worker (rem)
Industrial Radiography	0.54
Manufacturing and Distribution	0.49
Low-level Waste Disposal	0.14
Independent Spent Fuel Storage	1.04
Fuel Fabrication and Processing	0.43
Commercial Light Water Reactors	0.31

- The average radiation worker dose received from DOE operations in 1995 was 78 mrem per individual. This should be contrasted to background radiation levels of 27 mrem per individual from cosmic radiation, 28 mrem per individual from terrestrial sources, and 200 mrem from naturally occurring radon sources.[d]

Changes Impacting DOE Occupational Radiation Dose

- Change in operational status of facilities is the predominant driver behind changes in the collective dose. Significant reductions in the opportunities for individuals to be exposed occur as facilities are shut down and transitioned from operation to stabilization or decommissioning and decontamination.
- Changes to reporting requirements have significantly impacted the collective dose at DOE. The change in internal dose methodology from annual effective dose equivalent (AEDE) to committed effective dose equivalent (CEDE) between 1992 and 1993 resulted in a reduction of the collective TEDE by 28%, because the dose from prior intakes is no longer reported.
- Radiation protection practices have changed because of the implementation of the Radiological Control Manual (RadCon Manual). The RadCon Manual changed the methodology to determine internal dose, established Administrative Control Levels (ACL), standardized radiation protection programs, and formalized "As Low As Reasonably Achievable" (ALARA) practices.

References

[a] *Exposure of the U.S. Population from Diagnostic Medical Radiation,* National Council on Radiation Protection and Measurements, NCRP Report No. 100, Bethesda, MD, May 1989.

[b] *Occupational Radiation Exposure from U.S. Naval Nuclear Plants and Their Support Facilities*, Naval Nuclear Propulsion Program, Department of the Navy, Washington, DC, Report NT-95-2, March 1995.

[c] M.L. Thomas, D. Hagemeyer, *Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities*, NUREG-0713, Vol. 17, Draft, October 1996.

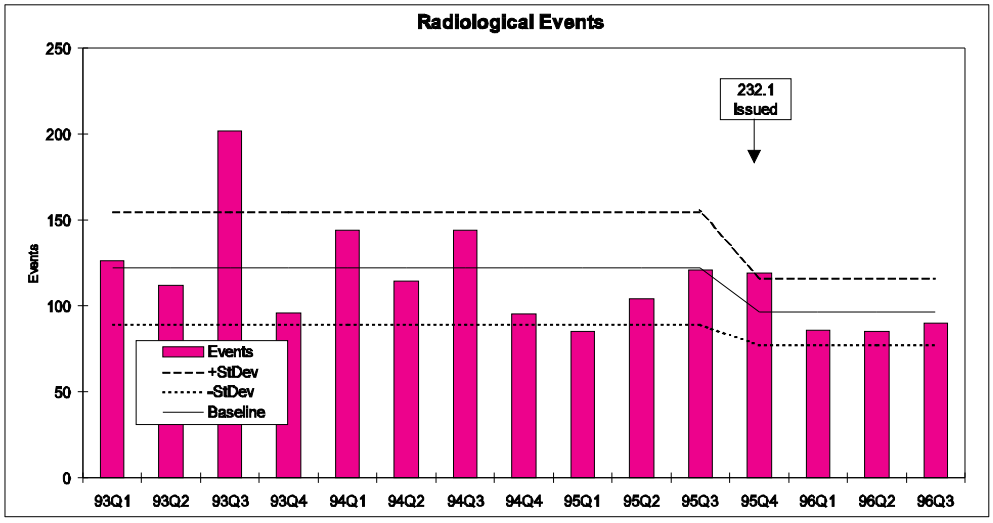
[d] Merril Eisenbud, *Environmental Radioactivity from Natural, Industrial and Military Sources,* 3rd Edition, by Academic Press, Inc.,1987.

Indicator

12. Radiological Events

Definition

Number of reportable radiological events as defined in DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information*. These events are made up of both personnel contaminations and radiation exposures which are reported as personnel radiation protection events.



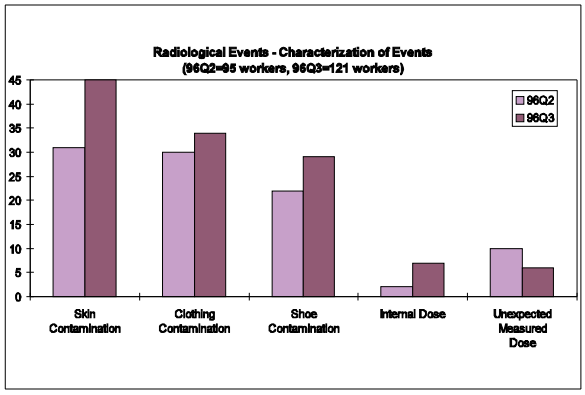
Source: Engineer Review of Occurrence Reports.

Key Observations

- A decreasing trend exists over the 15 quarters shown based on MLRT analysis. The most recent 3 quarters since the implementation of DOE 232.1 are significantly reduced compared to the previous baseline and appear to have no trend.
- 95 individuals were involved in the 85 reported radiological events during 96Q2, and 121 individuals were involved in the 90 reported radiological events during 96Q3. Of the events reported in 96Q2 and 96Q3, 22 involved more than one individual. This pattern is consistent with previous quarters.

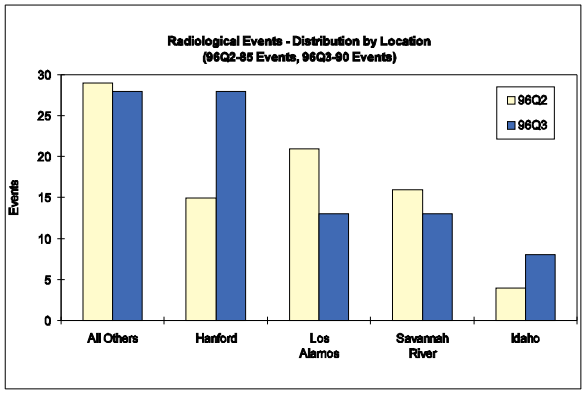
Additional Analysis

Characterization of Events



- Each event was assigned to one of the categories shown on the graph based on the most severe breach of personnel protection identified in an individual report. Unexpected doses are for those workers who were not contaminated, but received a higher dose than would have been expected for the area where they were working. Internal doses are for those cases where a confirmed uptake occurred.
- Health Physics Technicians were involved in 14 of the contamination events, and 3 events were discovered outside of controlled boundaries.

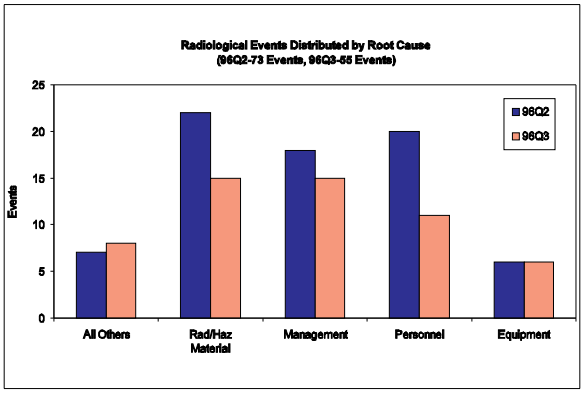
Distribution by Location



- The Tank Farm facility accounted for 16 of the 43 Hanford events reported in 96Q2 and 96Q3. Skin contaminations occurred on 45% (24 of 53) of the individuals involved at the Hanford site during 96Q2 and 96Q3. Hanford shows an increasing trend over the last 14 quarters based on MLRT analysis. At Los Alamos, one fifth of all events identified during 96Q2 and 96Q3 involved a radiological incident. 16 of the 34 Los Alamos radiological events reported in 96Q2 and 96Q3 involved contamination events at the TA-55 plutonium processing plant, including 8 glovebox contamination events. Skin contaminations during 96Q2 and 96Q3 occurred on 51% (23 of 45) of the individuals involved at the site. Los Alamos shows an increasing trend over the last 15 quarters based on MLRT analysis. Savannah River and Idaho show no trend in the number of events reported overall. Decreasing trends in radiological events at the Oak Ridge site and the Rocky Flats site were observed.
- During 96Q2, a visiting researcher from Oak Ridge National Laboratory (ORNL) alarmed a portal monitor while attempting to enter the High Flux Beam Reactor (HFBR) facility at Brookhaven National Laboratory. A particle had been deposited on the researcher's clothing at ORNL and transported among the personal clothing of the researcher to the HFBR facility.
- In Idaho, 5 workers had positive nasal smears as a result of the Waste Calcination Facility decontamination makeup room piping and vessel disassembly activities during 96Q3.
- During 96Q3, 6 Hanford workers were contaminated while exiting a High Radiation/Airborne Radioactivity Area. One of the workers experienced low flow to their air-supplied hood and contamination was spread to the affected employee and 5 additional personnel during the emergency removal of the hood.

Distribution by Facility Type: Plutonium processing facilities accounted for 29% of the radiological events reported in 96Q2 and 96Q3. Skin contaminations occurred on 52% (30) of the individuals involved. Nuclear waste operations and disposal facilities account for 25% of the total events reported in 96Q2 and 96Q3. In addition, nuclear waste operations and disposal facilities were the leading contributor (27) for 96Q3. Both facility types show an increasing trend over the last 15 quarters based on MLRT analysis.

Root Causes: The most commonly cited root cause reported during 96Q2 and 96Q3 was radiological/hazardous material problems (29% combined). This represents a shift from the previous 1-year period (95Q2-96Q1) when management problems was the most frequently cited root cause (45%). The radiological/hazardous material problems cause category was added during this time period.



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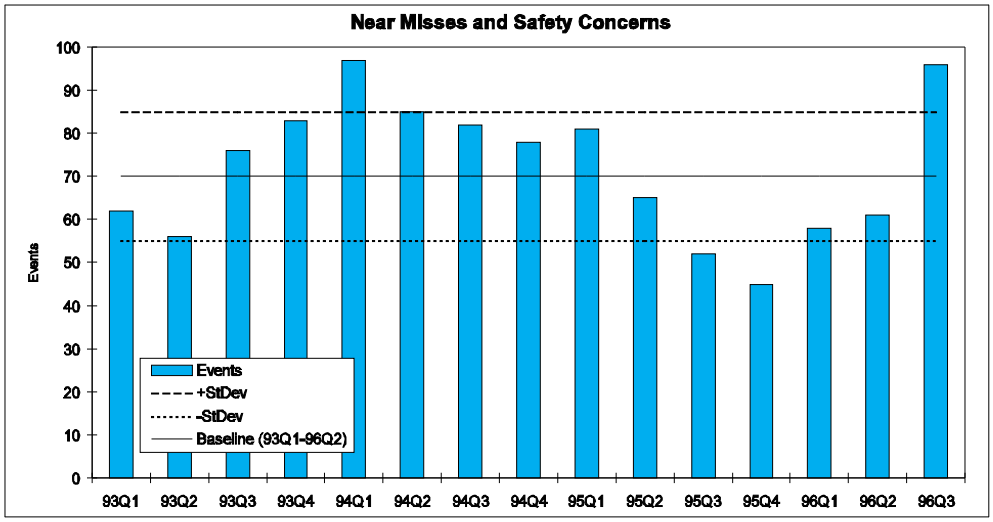
Indicator

13. Near Misses and Safety Concerns

Definition

Number of events related to near misses or safety concerns reportable under DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information.* A near miss occurs when all barriers to an event initiation are compromised, or if only one barrier remains to an event initiation after other barriers have been compromised. A safety concern exists if the unauthorized use of hazardous products or processes occurs, or if work is shut down as the result of an Occupational Safety and Health Administration violation.



Source: Engineer Review of Occurrence Reports.

Key Observations

- Electrical safety events continue to be the most commonly reported near miss condition during 96Q2 and 96Q3. However, the number of electrical safety events reported in 96Q3 almost doubled compared to the number of events reported in 96Q2 (96Q2=18, 96Q3=34). This is likely due to a heightened awareness DOE-wide of electrical safety issues over the last several quarters. Overall, there is an increasing trend in the number of electrical safety events reported as near misses over the last 15 quarters based on MLRT analysis.
- The number of fall protection and excavation shoring issues also continues to be significant during 96Q2 and 96Q3 (Both quarters=8 events), though fewer events were reported than during 96Q1 (11). No specific location was a dominant contributor to the total number of fall protection and excavation shoring issues reported during 96Q2 or 96Q3.

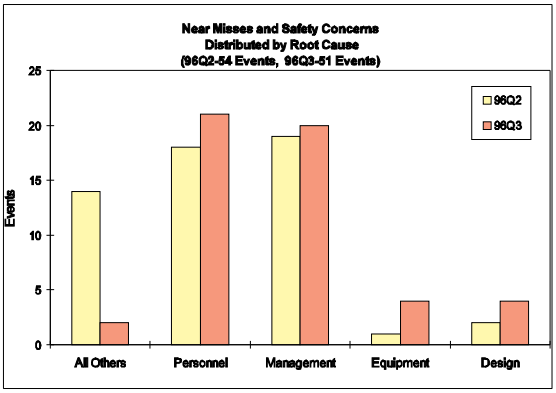
Additional Analysis

Characterization of Events

- The major types of events reported during 96Q2 and 96Q3 were:
  - Electrical Safety Events-52 (33%)
  - Radiation Protection Events-18 (11%)
  - Fall Protection/Excavation Shoring Events-16 (10%)
  - Hazardous Material Handling Events-11 (7%)
  - Events Involving Falling or Flying Objects-10 (6%)

- A review of the previous 13 quarters included 920 near miss and safety concern events. The distribution of the types of events for the 13-quarter period from 93Q1 through 96Q1 includes:
  - Electrical Safety Events - 197 (21%)
  - Radiation Protection Events - 89 (10%)
  - Improper Equipment Operation Events - 62 (7%)
  - Equipment Failure - 62 (7%)
  - Improper Work Controls - 54 (6%)
  - Fall Protection/Excavation Shoring Events - 49 (5%)
- The increase in 96Q3 near miss events is attributable to an increase in electrical safety events, equipment failures, and enclosed space hazards. However, there is no particular site or facility that is a dominant contributor to the increased reporting.
  - Excavation-related electrical safety events (96Q2=0, 96Q3=8)
  - Electrical arcing during maintenance (96Q2=1, 96Q3=6)
  - Structural failure in heavy equipment vehicle (96Q2=1, 96Q3=4)
  - Pressurized piping failure (96Q2=0, 96Q3=3)
  - Enclosed space hazards identified (96Q2=1, 96Q3=5)
- During 96Q2 and 96Q3, 157 events were reported. All but 8 were categorized as off-normal events. All of the 8 unusual events involved electrical safety issues.

Root Causes: During 96Q2 and 96Q3, personnel problems and management problems each accounted for 37% of the root cause total. Inattention to detail was the dominant sub-category (12). This differs from the previous 1-year period (95Q2-96Q1) when management problems accounted for 44% of the root cause total, while personnel problems only accounted for 30% of the root cause total.



Distribution by Facility Type

- During 96Q3, facilities involved in environmental restoration activities (16) and nuclear waste operations and disposal (13) contributed the most to the quarterly total by facility type. Both these facility types showed significant increases over 96Q2, when plutonium processing facilities were the leading contributors (8). There are no consistent trends apparent by facility type since 93Q1, and no single facility from any specific facility type was a dominant contributor to the 96Q2 or 96Q3 total.
- Construction, maintenance, and support groups accounted for 28% (27 events) of the reported events across all facility types during 96Q3.

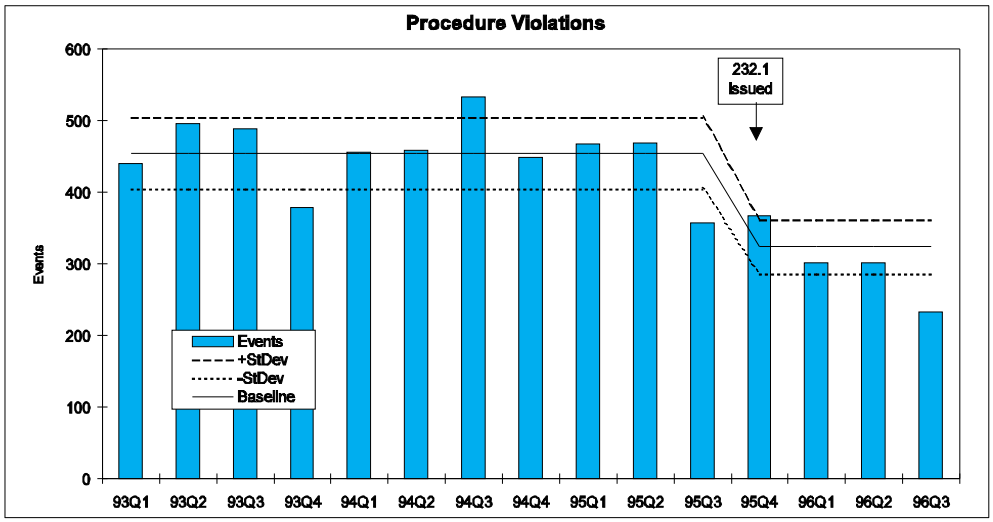
Distribution by Location: The types of events were varied, and no single facility from any location was a dominant contributor to the quarterly total or to any specific type of near miss characterization.

Indicator

14. Inadequate Procedures/Procedures Not Followed

Definition

Number of reportable events as defined in DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information*, which are either categorized as procedure violations or problems, or which are reported as being caused by a procedure violation or problem.



Source: Engineer Review of Occurrence Reports

Key Observations

- A decreasing trend exists over the 15-quarter period displayed based on MLRT analysis. This trend is especially apparent over the last 8 quarters. No specific change or group of changes in reporting thresholds can be associated with the downward trend. However, since procedure violations can be identified with any reported event as a cause, the general raising of event reporting thresholds (effected through Order 232.1) appears to be the most significant influencing factor. Note that at the time of the analysis, a cause had been determined for only 59% of the 96Q3 occurrence reports.

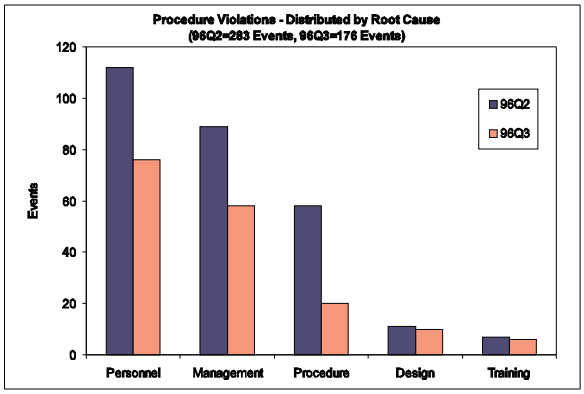
Additional Analysis

Characterization of Events

- The major types of events reported during 96Q3 were:
  - Administrative-Related Events-62 (27%)
  - Maintenance-Related Events-27 (12%)
  - Physical Control of Radioactive Material Events-27 (12%)
  - Equipment Operation-Related Events-26 (11%)
- Of the administrative-related events, access control of radiation control areas (18 events, 29%) and administrative control of radioactive material (17 events, 27%) were the most common problems cited.
- These totals are consistent with the 96Q2 totals, except that maintenance-related events have doubled (96Q2=14, 96Q3=27). Maintenance related events include lockout/tagout difficulties and work permit problems.

Root Causes: During 96Q3, the most frequently cited personnel error subcategories were failure to use the procedure (34) and inattention to detail (34). Inadequate policy

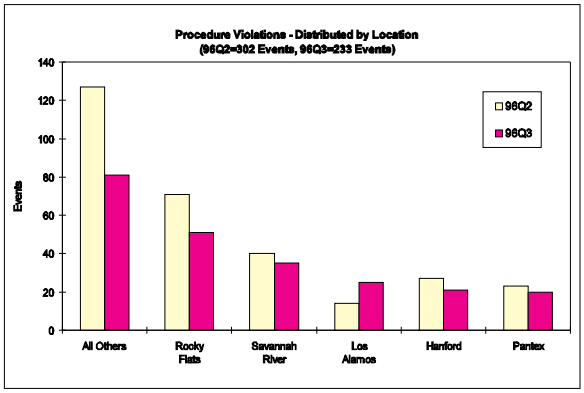
definition (20) was the most commonly noted management problem. Inadequate procedures were noted in 15 events. The distribution of events is similar for 96Q2.



Distribution by Facility Type: The 2 largest contributors (40%) by facility type for 96Q3 are plutonium processing (25%) and nuclear waste operations/disposal (15%). This distribution is consistent with the last 14 quarters.

Distribution by Location

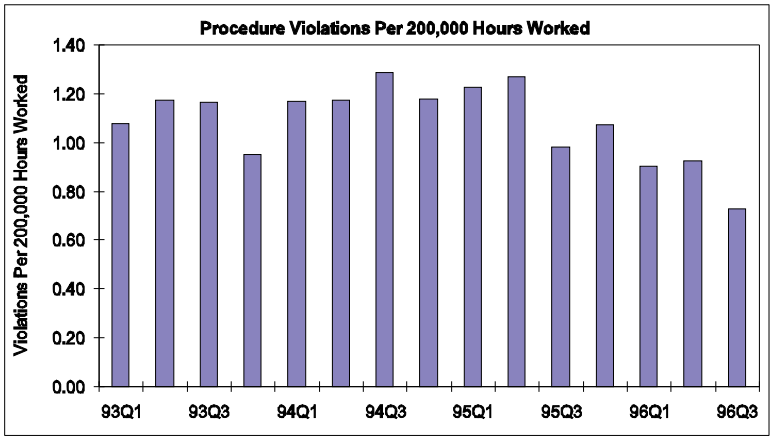
- Rocky Flats reported one-fifth (51 events, 22%) of the procedure violations during 96Q3. Savannah River reported 15% (35) and Los Alamos National Laboratory reported 11% (25) of the total procedure problems.



  - Rocky Flats has been the leading contributor for 4 consecutive quarters. During 96Q2 and 96Q3, 57% of the events reported by Rocky Flats involved an administrative problem. This is double the overall rate of administrative discrepancies reported by all locations during these quarters.

  - Savannah River has been the 2nd leading contributor for 2 consecutive quarters. During 96Q2 and 96Q3, the majority (18 events, 24%) of the procedural problems reported by Savannah River involved equipment operation issues. This accounts for 69% of the total equipment operation-related procedural problems reported during these quarters.

Normalized Data: When procedure violations are normalized per 200,000 hours worked, the graph remains similar to the graph of events per quarter, although the peak at 94Q3 is not as prominent. The most recent 3 quarters indicate a rate less than 1.0.

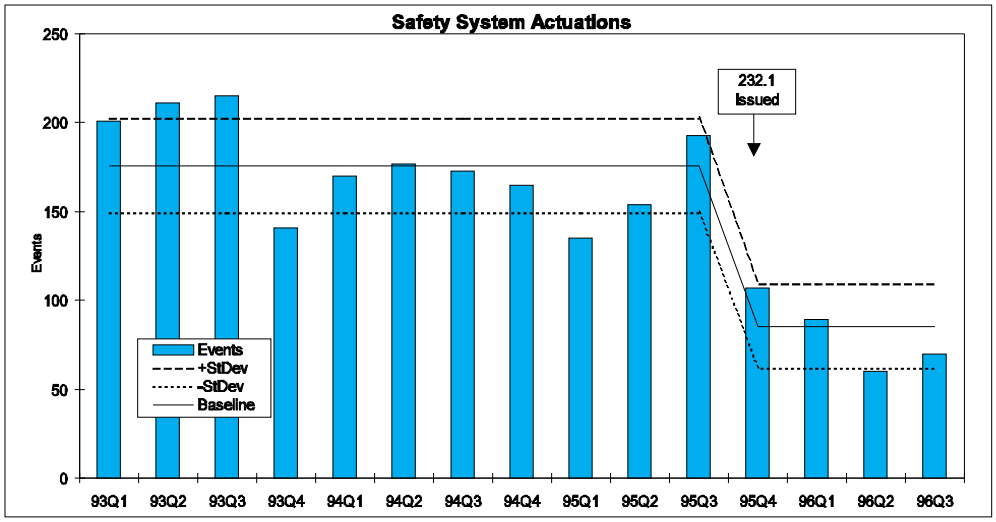


Indicator

15. Safety System Actuations

Definition

Number of operations-related events determined to be safety system actuations reportable under DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information.* This includes actuation of any safety class equipment or alarm, unplanned electrical outages, unplanned outages of service systems, serious disruption of facility activity related to weather phenomenon, facility evacuations, or loss of process ventilation. These events have the potential to impact the safety and health of workers in the vicinity.



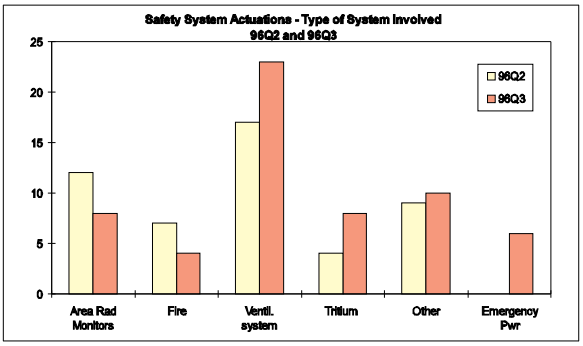
Source: Engineer Review of Occurrence Reports.

Key Observations

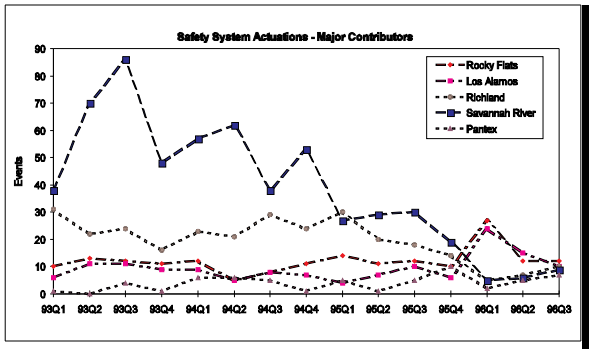
- The decrease in the DOE total between 96Q1 and 96Q2 (from 89 to 61 events) can be attributed to the decreases at Rocky Flats (from 27 to 13 events) and Los Alamos (from 24 to 15 events).

Additional Analysis

- The decrease in the number of safety system actuations reported between 95Q3 and 95Q4 can be attributed to implementation of changes in the occurrence reporting Order from 5000.3B to 232.1. This was confirmed through discussions with field personnel. The primary changes to reporting criteria, which impact this indicator, involve deleting the requirements to report inadvertent/false alarms, unless they are considered by the site to be significant, and precautionary facility evacuations.
- The increase in safety system actuation events between 96Q2 and 96Q3 corresponds to an increase in power outages (which generally impact ventilation or alarm systems).
- The type of systems involved for 96Q2 and 96Q3 safety system actuations are shown in the graph. The category "other" includes events such as pressure alarms, hazardous chemicals, oxygen levels, and experiment damage. About 10%



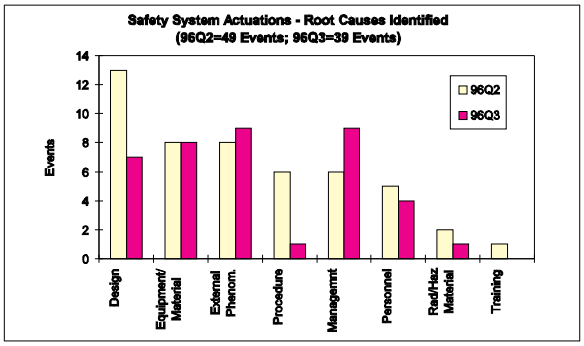
of the events during 96Q2 and 96Q3 involved gloveboxes.



Distribution by Location: The top five contributors complex-wide are shown in the graph. Both Los Alamos and Rocky Flats reported significant decreases between 96Q1 and 96Q2.

- The decrease at Rocky Flats (96Q1=27; 96Q2=13) can be attributed to fewer events related to ventilation systems and frozen or ruptured piping.
- The decrease at Los Alamos resulted primarily from a decrease in glovebox-related safety system actuation events (from 17 in 96Q1 to 6 in 96Q2).
- Since 93Q1, a decreasing trend has been observed for Savannah River based on MLRT analysis.

Root Causes: The leading root causes for 96Q2 and 96Q3 events with root causes identified are shown in the graph. Since DOE Order 5000.3B was issued in February 1993, equipment/material problems, management problems, and design problems have been the top 3 root causes for safety system actuations. 96Q2 was the first quarter that design problems were the leading root cause and that management problems were not one of the top 3 causes. Root causes were identified for 82% of the 96Q2 release events and 56% of 96Q3 release events.



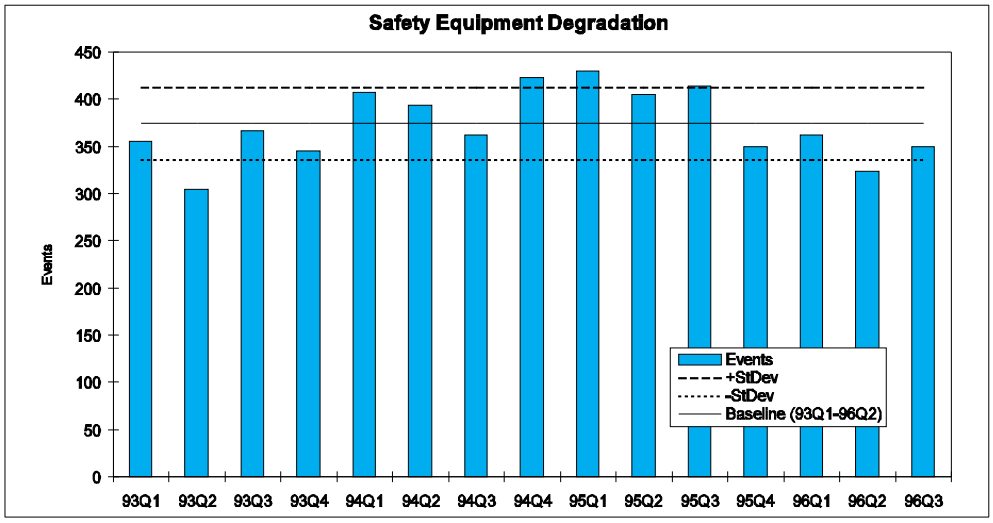
Indicator

16. Safety Equipment Degradation

Definition

Number of reportable events categorized as "vital system/component degradation" as defined in DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information*.

Safety equipment degradation includes: (1) any unplanned occurrence that results in the safety status or the authorization basis of a facility or process being seriously degraded; or (2) a deficiency such that a structure, system, or component (SSC) vital to safety or program performance does not conform to stated criteria and cannot perform its intended function; or (3) unsatisfactory surveillance/inspections and appraisal findings of any safety class SSC.



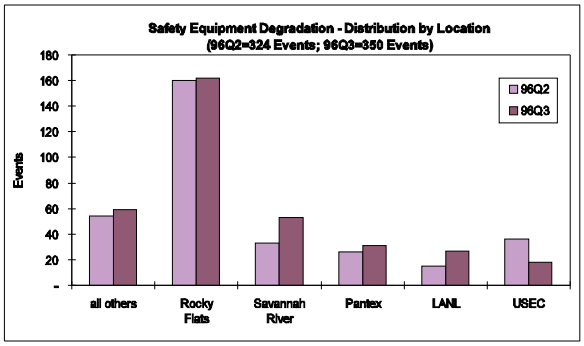
Source: Engineer Review of Occurrence Reports.

Key Observations

- A decreasing trend in safety equipment degradation events has been observed since 94Q1 based on MLRT analysis.

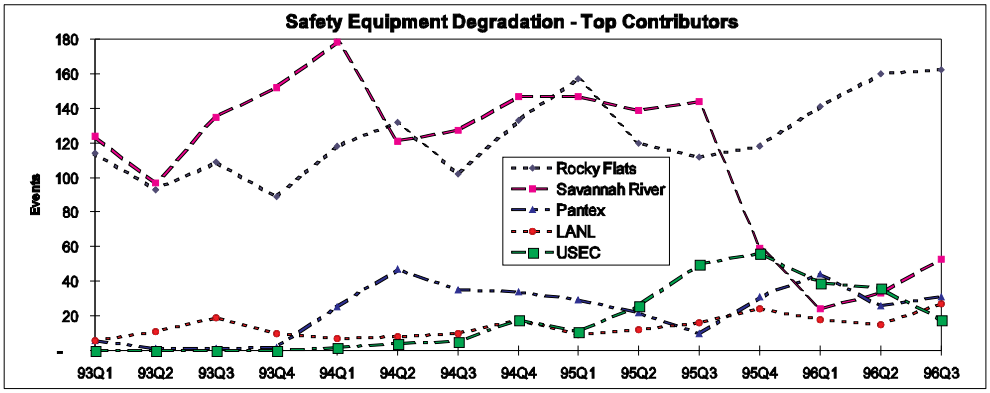
Additional Analysis

Distribution by Location

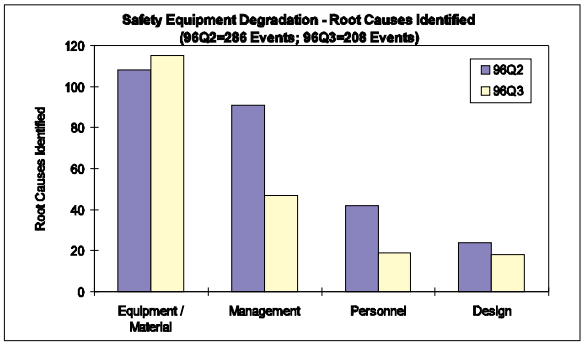


- Distributions for the major contributors of safety equipment degradation events for 96Q2 and 96Q3 are shown in the graph. The biggest contributor in both quarters was Rocky Flats (96Q2=49%; 96Q3=46%). For both quarters, approximately one-fourth of all safety equipment degradation events at that site were related to defective/degraded Selective Alpha Air Monitors (SAAM) and Continuous Air Monitors (CAM). Rocky Flats shows an increasing trend in safety equipment degradation events since 93Q1 based on MLRT analysis.
- Safety equipment degradation events at Savannah River dropped by 41% from 95Q3 to 95Q4 (95Q3=144; 95Q4=59). Based on discussions with DOE field personnel, the reason for this dramatic drop is Savannah River's early

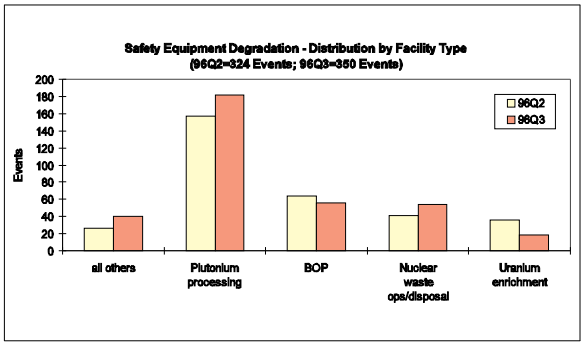
implementation of the change in occurrence reporting as established in DOE Order 232.1. These changes, as interpreted by that site, have the effect of raising the local reporting thresholds with respect to the definitions of safety significant systems, thereby lowering the number of events reported.



Root Causes: The graph shows distributions of major root causes of safety equipment degradation events for 96Q2 and 96Q3. Historically, the largest root cause category has been equipment/material problems, with the sub-category defective or failed parts averaging 89% of equipment/material problems 93Q1.



Distribution by Facility Type: Distributions of safety equipment degradation by facility type for 96Q2 and 96Q3 are shown in the graph. Historically, plutonium processing facilities have been the largest contributor to safety equipment degradation events, averaging about 36% of the total since 93Q1.

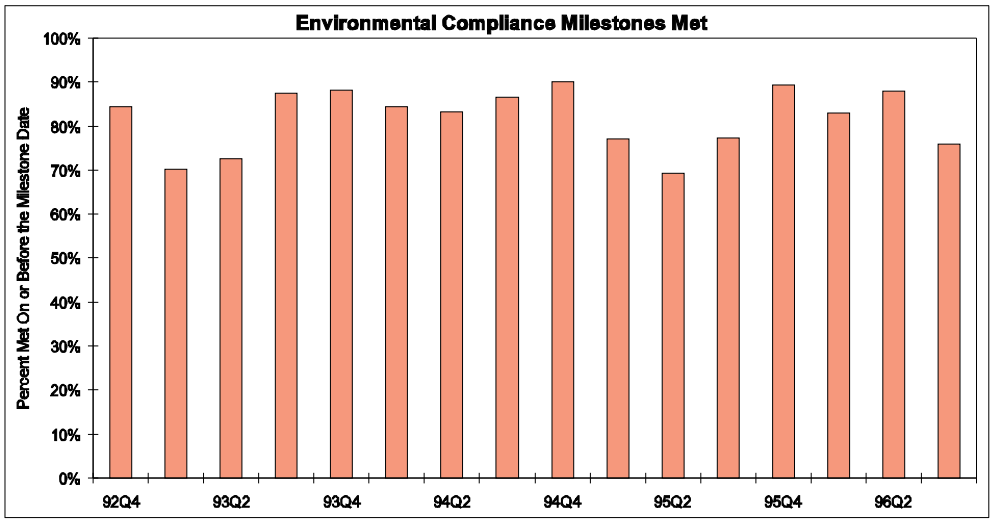


Indicator

17. Environmental Compliance Milestones Met

Definition

Enforceable requirements in environmental agreements, met on or before the milestone date (percent).



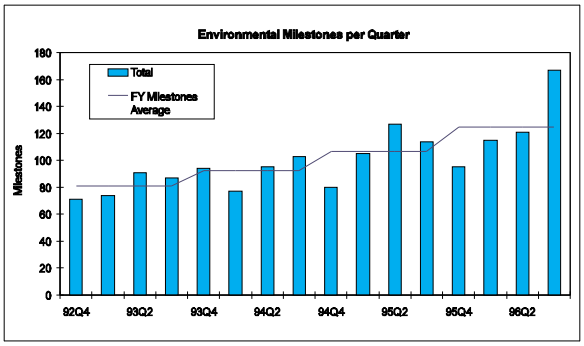
Source: Progress Tracking System Data, Office of Environmental Management.

Key Observations

- In the most recent 2 quarters, DOE missed almost 1 out of 8 and 1 out of 4 enforceable compliance milestones, respectively.
- Over the past 4 quarters, DOE has missed more than 1 out of 6 enforceable compliance milestones.

Additional Analysis

- In the most recent 4 quarters (FY 1996), 83% of the milestones were completed on time. This is similar to the record for the prior 3 years.
- Based on revised data for FY 1996, the number of compliance milestones is increasing every year. There were 323 milestones in FY 1993, and 498 in FY 1996.
- The previous report included projected rates for 96Q2 and 96Q3, based on milestones identified as "forecast delay" as of April 30, 1996. The projected rate in the previous report for 96Q2 was 91%; the actual rate was 88%. The projected rate for 96Q3 was 94% (and based on July 30 data, it was 91%); the actual rate is 76%. Forecasts are apparently optimistic relative to actual achievement. The usefulness of including such projections in subsequent performance indicator reports will be evaluated in the future.



- These data do not capture all enforceable milestones; they reflect those milestones under the purview of the Office of Environmental Management. EM's Progress Tracking System is believed to capture 85–90% of all DOE enforceable environmental milestones.

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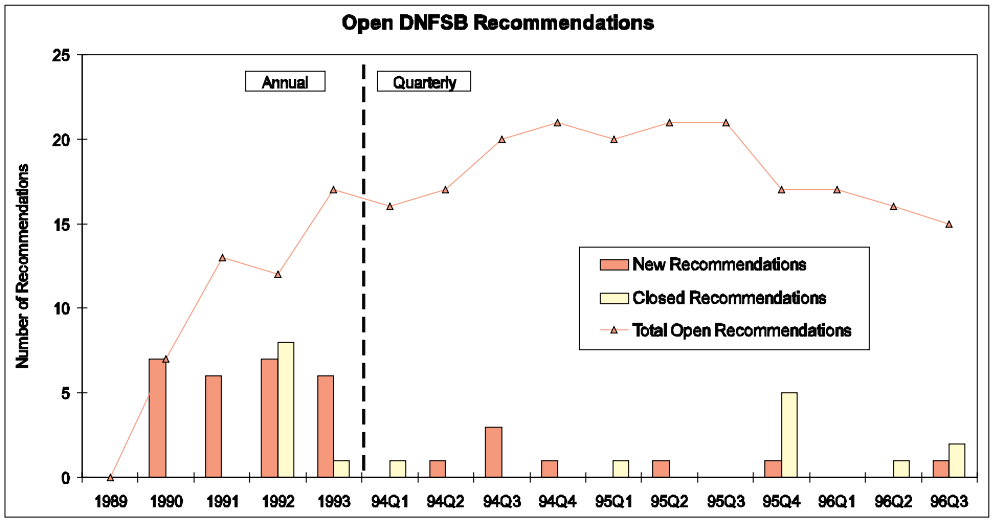
Indicator

18. Open DNFSB Recommendations

Definition

The cumulative number of open Defense Nuclear Facilities Safety Board (DNFSB) recommendations. DNFSB recommendations only apply to DOE defense nuclear facilities and, therefore, are representative only of DOE defense facilities involved in nuclear safety issues.

Each DNFSB recommendation accepted by DOE leads to an implementation plan containing a set of commitments which, when fully implemented, will resolve the safety issues and lead to closure of the recommendation. A commitment is any documented obligation by the Secretary, or designee, that describes products to be delivered on a specified schedule. Commitments resulting from DNFSB recommendations are tracked by the Office of the Departmental Representative to the DNFSB (S-3.1) as completed (fulfilled), not yet due, and overdue.



Source: Safety Issues Management System.

Key Observations

- After September 1996, there were 15 open DNFSB recommendations representing 924 DOE commitments. 58% of the commitments were considered to be satisfied or fulfilled. A total of 3 recommendations were closed during 96Q2 and 96Q3, while 1 recommendation was added.
- 73% of the DNFSB recommendations were classified as “Heading to Closure” or making “Steady Progress” by S-3.1 at the end of September 1996. Only 59% of the open DNFSB recommendations met this classification after March 1996.

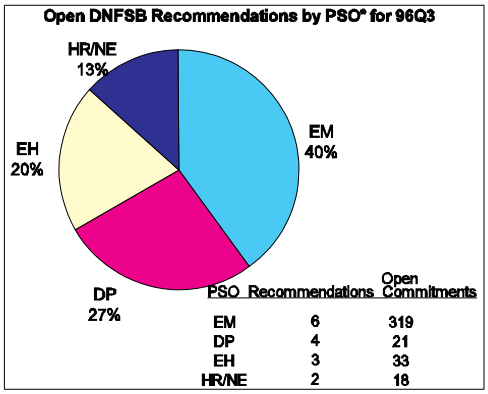
Additional Analysis

- Environmental Management (EM) and Defense Programs (DP) continue to be responsible for implementing most of the recommendations. The cumulative subtotals through 96Q3 are represented in the table on the following page. Recommendation 96-1 (In-Tank Precipitation System) does not currently have an approved implementation plan and, therefore, does not represent any commitments.

Office	DNFSB Recommendations	Commitments	Fulfilled	Not Yet Due	Overdue
EM	6	652	333 (51%)	237 (36%)	82 (13%)
DP	4	105	84 (80%)	20 (19%)	1 (1%)
EH	3	77	44 (57%)	17 (22%)	16 (21%)
HR/NE	2	90	72 (80%)	4 (4%)	14 (16%)
Total	15	924	533 (58%)	278 (30%)	113 (12%)

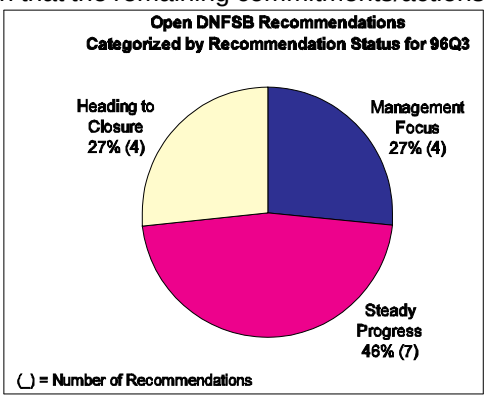
Distribution of Open Commitments

- There continues to be an improving trend in the number of open commitments (the sum of overdue commitments and not yet due commitments based on a projected schedule of completion incorporated within the implementation plans). There were 694 open commitments as of July 1995. At the end of June 1996, there were only 436 open commitments and September 1996 ended with only 391 open commitments. As a subset of open commitments, overdue commitments continue to be aggressively addressed. There were 259 overdue commitments (26% of total) after March 1996, 135 after June 1996, and 113 (12% of total) after September 1996. Of these 113 overdue commitments, 103 were overdue by 3 months or more. These trends are influenced by a re-baselining of the commitments for 2 recommendations during 96Q2



- EM facilities account for 40% of the open recommendations for 96Q3; however, EM facilities account for 82% of the open commitments.
- 3 of the 15 open recommendations are more than 80% complete.

Characterization of Recommendation Status: The graph shows an evaluation by S-3.1 on the number of open DNFSB recommendations categorized by recommendation status. A status of "Heading to Closure" includes the existence of a clearly defined path to closure, and the expectation that the remaining commitments/actions can be completed within the next year. "Steady Progress" implies the existence of an acceptable implementation plan with most commitments/deliverables generally being completed on schedule. Recommendations classified as "Management Focus" involve difficulties with (or lack of) an implementation plan or a large number (10) of overdue commitments. 4 recommendations were upgraded and removed from the Management Focus category during 96Q2.



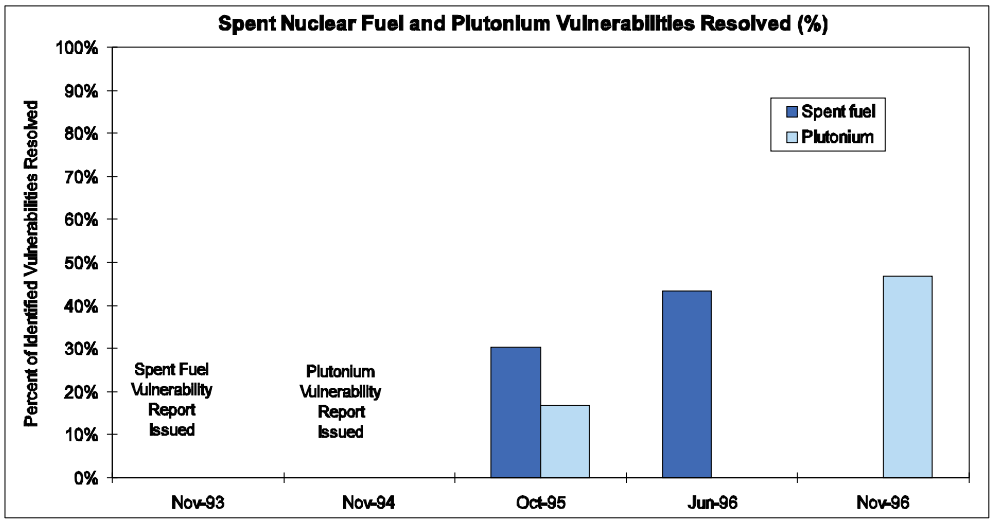
Indicator

19. Spent Nuclear Fuel and Plutonium Vulnerabilities Resolved

Definition

The number of resolved plutonium and spent fuel vulnerabilities divided by the total number of vulnerabilities as defined in *Spent Fuel Working Group Report on Inventory and Storage of the Department's Spent Nuclear Fuel...and Their Environmental, Safety, and Health Vulnerabilities,* Volume 1, November 1993, and *Plutonium Working Group Report on Environmental, Safety, and Health Vulnerabilities*, Volume 1, November 1994 (DOE/EH-0415).

An ES&H vulnerability is defined in the plutonium and spent fuel vulnerability reports as "conditions or weaknesses that could lead to unnecessary or increased radiation exposure of workers, release of radioactive material to the environment or radiation exposure of the public." A resolved vulnerability implies that the cited condition no longer exists, the risk has been minimized to an acceptable level, or the risk has been evaluated at an active facility and judged to be acceptable. Vulnerabilities can be characterized as material/packaging (e.g., storage of unstable and corrosive solutions), facility condition (e.g., facility weaknesses), or institutional vulnerabilities (e.g., loss of experienced personnel). The vulnerabilities were ranked by significance based on the likelihood of an accident and the perceived consequences.



Source: Draft Plutonium Vulnerability Management Summary Report, November, 1996 (EM-66),
Report on Status of Corrective Actions to Resolve Spent Nuclear Fuel Vulnerabilities, June, 1996 (EM-67).

Key Observations

- There were 299 plutonium vulnerabilities identified at 13 sites and 106 spent nuclear fuel vulnerabilities identified at 8 sites based on reports issued in 1993 and 1994.
- As of 96Q3, 47% of the identified plutonium vulnerabilities have been resolved.
- As of 96Q2, 43% of the identified spent fuel vulnerabilities have been resolved.

Additional Analysis

- The most spent nuclear fuel vulnerabilities were identified at Hanford, which maintains 80% of the DOE total spent nuclear fuel inventory by weight.

- The following table indicates the breakdown of spent nuclear fuel vulnerabilities as of 96Q2 by location and the progress of resolving the identified vulnerabilities.

Spent Nuclear Fuel Site	Vulnerabilities Identified	Vulnerabilities Resolved	Percent Resolved
Hanford	36	18	50%
Idaho	33	6	18%
Savannah River	21	13	62%
All Others	16	9	56%
Total	106	46	43%

- The most plutonium vulnerabilities were identified at Rocky Flats, which maintains 80% of the DOE total plutonium inventory by weight. Of these 87 vulnerabilities, 16 have been closed and an additional 18 have had the risk reduced to an acceptable level.
- Los Alamos had similar success pursuing plutonium vulnerabilities with 14 issues closed and the risk in 22 other issues reduced to an acceptable level.
- The following table indicates the breakdown of plutonium vulnerabilities as of 96Q3 by location and the progress of resolving the identified vulnerabilities.

Plutonium Site	Vulnerabilities Identified	Vulnerabilities Resolved	Percent Resolved
Rocky Flats	87	34	39%
Los Alamos	60	36	60%
Savannah River	40	13	33%
Hanford	34	9	26%
All Others	78	48	62%
Total	299	140	47%

- 16 of the top 46 highest risk plutonium vulnerabilities, DOE-wide, have been resolved. 10 were completed; the risk for 6 other issues has been reduced or judged acceptable.

Indicator

20. Plutonium Stabilization

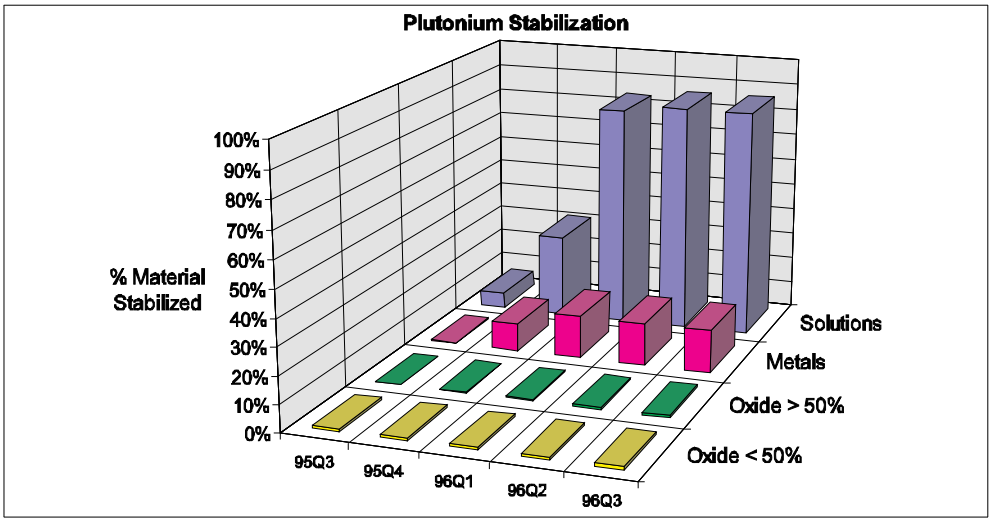
Definition

Progress in plutonium (Pu) stabilization as outlined in the DOE implementation plan response to DNFSB Recommendation 94-1. The performance measure is depicted in cumulative percentages of the total inventory (in stabilization units; SU) of plutonium solutions, metals, and oxides that are stabilized.

1 Pu solution SU = 4000 liters

1 metal SU = 90 kg

1 oxide SU = 60 kg



Source: Nuclear Materials Stabilization Task Group Quarterly Report, June 1 - August 31, 1996,
BNL Data Base on Plutonium Stabilization, September, 1996.

Key Observations

- DOE-wide, the milestones for stabilization of the various Pu forms for 1996 have been met by 96Q3. The progress in stabilization of Pu metal has far exceeded the goal set by the implementation plan.

Additional Analysis

Distribution by Location

- Savannah River initially accounted for 86% of the Pu solution inventory requiring stabilization, and 90% of the Savannah River inventory has been stabilized.
- Rocky Flats initially accounted for 40% of the metals inventory requiring stabilization, and 29% of the Rocky Flats inventory has been stabilized. Savannah River initially accounted for 49% of the metals inventory requiring stabilization and 8% of the Savannah River inventory has been stabilized.
- Rocky Flats initially accounted for 58% of the Pu oxides (>50% assay) inventory requiring stabilization, and 51% of the Pu oxides (<50% assay) inventory requiring stabilization.

Future Planning

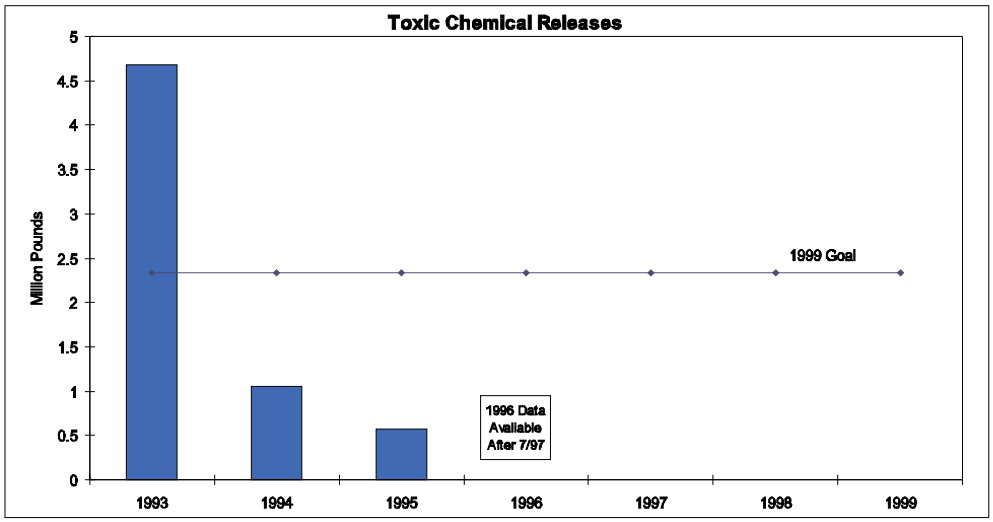
- Richland will decelerate stabilization of polycubes (polystyrene cubes impregnated with plutonium oxide that generate gases rapidly and are difficult to store safely) and allow resources to be focused on higher priority solution stabilization and packaging. It is still expected that polycube stabilization will be completed on schedule (January 2001).
- The Mound site is expected to ship all Pu holdings to Los Alamos before the end of 1996.
- A prototype Pu stabilization and packaging unit is expected to be installed at Rocky Flats by the end of March 1997. The design was approved during 96Q3. This equipment, including the storage container, is expected to become the DOE standard for long-term storage of Pu.

Indicator

21. Toxic Chemical Releases

Definition

Toxic Release Inventory (TRI) chemicals released or transferred off-site for treatment and/or disposal (pounds).



Source: Individual site Section 313 Form R reports. 1995 data not yet validated by sites.

Key Observations

- Executive Order 12856[a] requires Federal agencies to reduce their toxic chemical releases and off-site transfers by 50% before December 31, 1999, using a pre-established baseline year of 1993. DOE's reported releases continue to decrease, from 4,678,000 pounds in 1993, to 1,048,500 pounds in 1994, and to 577,000 pounds in 1995.

Additional Analysis

Reporting Requirements and Goals

- Executive Order 12856 directed all Federal agencies to reduce releases and off-site transfers of toxic chemicals by 50% before December 31, 1999 [as reported in the Emergency Planning and Community Right-to-Know Act's Toxic Chemical Release Inventory (TRI)] .
- DOE's 1993 baseline total is 4,678,000 pounds. This is 0.1% of the 1993 industry-wide total.

DOE TRI

- The number of DOE sites reporting under TRI has decreased from 23 in 1993 to 22 in 1994 and 17 in 1995.
- The number of Form R's submitted has changed from 89 in 1993 to 91 in 1994 to 54 in 1995.
- The number of chemicals reported by DOE under TRI has changed from 28 in 1993 and 1994 to 21 in 1995.
- The amount of toxic chemicals transferred off-site for treatment and/or disposal has changed from 35,210 pounds in 1993 to 57,141 pounds in 1994 to 6,250 pounds in 1995.
- Methanol accounted for 79% (3,666,000 pounds) of DOE's total TRI in 1993. Naval Petroleum Reserve #1 (NPR#1) reported 81% (3,783,000 pounds) of the DOE TRI

baseline, of which 3,614,000 pounds were methanol. In 1994, reported methanol releases at NPR#1 were reduced by more than 90% below releases reported for 1993 (to 313,000 pounds) by improving estimates based on sampling and monitoring.

- Portsmouth Gaseous Diffusion Plant also reported a major decrease (from 172,000 pounds in 1993 to 2,781 pounds in 1994). The decrease is entirely due to approximately 170,000 pounds of dichlorotetrafluoroethane (Freon 114) reported in 1993 (and none in 1994). The decrease in the amount Portsmouth reported to DOE is due to the transfer of Portsmouth operations to the U.S. Enrichment Corporation in mid-1993; USEC is now responsible for reporting.

Reference

[a] Executive Order 12856, *Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements*, signed August 2,1993.

Indicator

22. Pollution Prevention

Definition

In May 1996, the Department set the following goals to be achieved by December 31, 1999, using calendar year 1993 as a baseline year.[a]

- Reduce by 50% the generation of radioactive waste (for routine operations).
- Reduce by 50% the generation of low-level mixed waste (for routine operations).
- Reduce by 50% the generation of hazardous waste (for routine operations).
- Reduce by 33% the generation of sanitary waste (for routine operations).
- Reduce by 50% total releases and off-site transfers for treatment and disposal of toxic chemicals (for routine operations).
- Recycle 33% of sanitary waste (for all operations, including cleanup/stabilization activities).
- Increase procurement of Environmental Protection Agency-designated recycled products to 100%, except where they are not commercially available competitively at a reasonable price or do not meet performance standards.

Key Observations

- Current data are provided in this report for Toxic Chemical Releases. Work is ongoing to evaluate possible measures for these goals.

Reference

[a] Memorandum “Departmental Pollution Prevention Goals” Hazel O’Leary to Heads of Departmental Elements, May 3, 1996, reprinted in *Pollution Prevention Program Plan 1996*, DOE/S-0118

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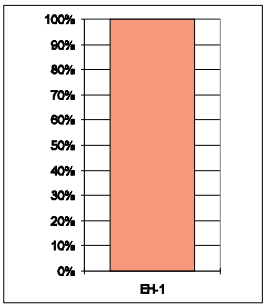
The Secretary's Commitments to the President in ES&H and EQ

Environment, Safety and Health (ES&H) and Environmental Quality (EQ) commitments as part of the Secretary of Energy's Performance Agreement with the President for Fiscal Year 1996 are summarized below. More information related to the status of these commitments can be obtained from DOE's Office of Policy or via the World Wide Web at http://www.doe.gov.

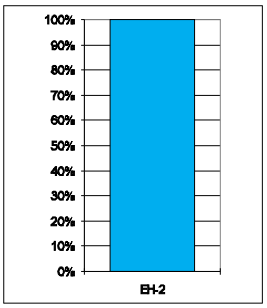
Environment, Safety and Health (ES&H) Commitments

EH-1



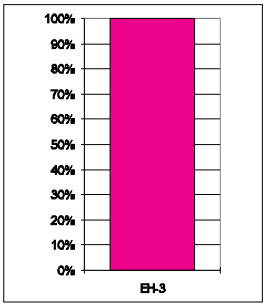
EH-1: Incorporate the risk-based ES&H planning and budgeting process into all new or renewed major Management and Operation (M&O) contracts.	
Success Measure	**Status**
6 M&O contracts by 9/96	Completed 18 in FY 96.

EH-2



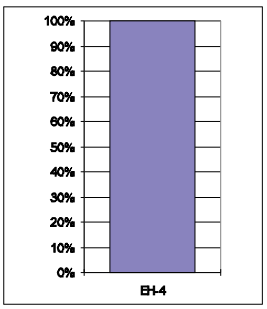
EH-2: Complete Highly Enriched Uranium (HEU) Vulnerability Study to identify ES&H vulnerabilities.	
Success Measure	**Status**
0 unaddressed serious HEU vulnerabilities by 9/96	HEU Vulnerability Study completed in FY 96. 155 serious vulnerabilities identified; all being addressed by corrective action plans.

EH-3



EH-3: Implement the "Necessary and Sufficient Closure Process" (now called "Work Smart Standards") to ensure safe operations in a streamlined environment.	
Success Measure	**Status**
9 pilot projects in FY 95. Begin full implementation by 2/96	Completed in FY 96.

EH-4

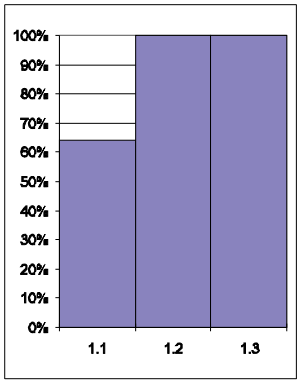


EH-4: Institutionalize a multi-disciplinary fully integrated oversight process for evaluating ES&H and safeguards and security programs.	
Success Measure	**Status**
Value-added, comprehensive oversight evaluations at 7 DOE sites by 9/96	Completed in FY 96.

Environmental Quality (EQ) Commitments

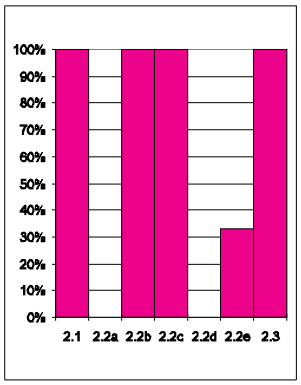
EQ-1: Understand and deal with the risks associated with environmental problems resulting from nuclear weapons production during the Cold War.		
Success Measure		**Status**
1.1	Complete sampling, analysis and characterization of 25 high-level radioactive waste tanks at Hanford.	64% completed as of 6/96. 16 tanks sampled, analyzed and characterized.
1.2	Finish analysis of DOE “materials in inventory,” including path forward for at least 10 material types, including lithium, chemicals, and weapons components.	100% completed.
1.3	Submit an updated Baseline Environmental Management Report to Congress in May 1996.	100% completed.

EQ-1



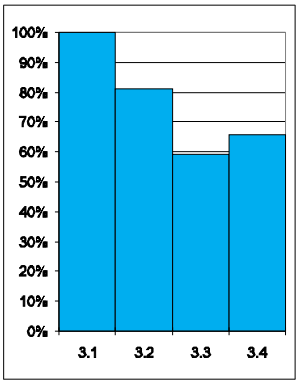
EQ-2: Make progress on mixed waste treatment.		
Success Measure		**Status**
2.1	Reach agreements at seven remaining sites by 12/95. (Recommended change in wording for success measure to “Complete activities required to finalize plans and orders at remaining sites.”)	100% completed.
2.2	Meet the 130 milestones for FY 1996 for waste characterization and treatment activities, including: (Recommended change in wording of success measure to ”Meet milestones for FY 1996 for waste characterization and treatment activities,..”)	
2.2a	Award a contract for privatized treatment of certain waste streams at Oak Ridge Reservation.	0% completed as of 6/96. Completed Phase I technology and process qualification; contract to demonstrate process reliability, safety, and cost-effectiveness will be awarded 4th quarter FY 1996; contract for treating sludges will be awarded in FY 1997.
2.2b	Award a contract for privatized treatment of certain waste streams at Hanford site.	100% completed.
2.2c	Request proposals for advanced mixed waste treatment facility at Idaho National Engineering Laboratory.	100% completed.

EQ-2



2.2d	Start operations of the Consolidated Incineration Facility at Savannah River Site.	0% completed as of 6/96. Measure missed due to hardware problems; trial burn schedule adjusted to allow for plant modifications with expected completion end of CY 1996.
2.2e	Treat more than 180,000 cubic meters of mixed waste. (Recommended change in wording to ”Manage 85,423 cubic meters of low-level mixed waste in base inventory,,” as reported in the Waste Management Critical Few indicators.)	33% completed as of 6/96. LLMW inventory reduced from 85,423 cubic meters to 57,455 cubic meters. Currently managing what was planned.
2.3	Submit an updated Baseline Environmental Management Report to Congress in May 1996.	100% completed.

EQ-3

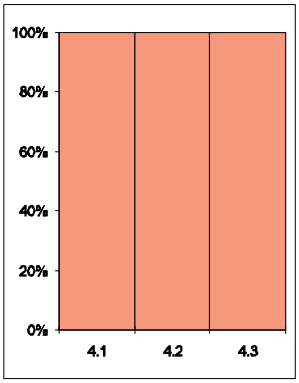


EQ-3: Reduce the ES&H risks; clean up nuclear weapons sites.

Success Measure		Status
3.1	Complete 120 environmental cleanup actions.	107% completed as of 6/96. 128 environmental cleanup actions completed as of 6/30/96.
3.2	Stabilize 250 kg of plutonium residues and solutions at Hanford and Savannah River sites.	81% completed as of 6/96. 202 kg of plutonium residues and solutions stabilized as of 6/30/96.
3.3	Finish 12 decommissioning projects and 154 Uranium Mill Tailings Remedial Action (UMTRA) property clean-ups. (Recommended change in wording to “Finish 43 decommissioning projects and 137 vicinity property cleanups,,” as referenced in the EM FY 1996 Performance Plan.)	59% [(13/43)(.5) + (121/137)(.5)] completed as of 6/96 . 13 of 43 decommissioning projects and 121 of 137 vicinity property remedial actions completed as of 6/30/96.
3.4	Treat and/or dispose of more than 3 million cubic meters of DOE waste, including startup vitrification of high-level radioactive waste at the Defense Waste Processing Facility at Savannah River by 12/95 and at West Valley Demonstration Project by 3/96. (Recommended change in wording to “Manage 348,211 cubic meters of high-level waste in inventory, including...”)	66% [(348211-346137/348211)(.33) + (1/1)(.33) + (1/1)(.33)] completed as of 6/96. HLW inventory reduced from 348,211 cubic meters to 346,137 cubic meters. Radioactive processing operations initiated at DWPF on 3/12/96; West Valley Demonstration Project received authorization to begin processing radioactive high-level waste on 6/19/96.

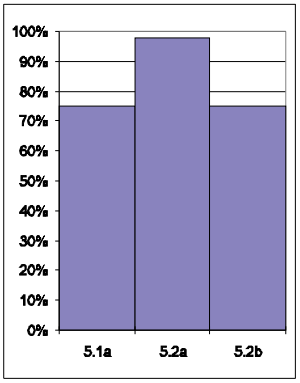
EQ-4: Find solutions to spent nuclear fuel storage and funding issues.		
Success Measure		**Status**
4.1	Issue by 3/96 a revised program plan to determine the suitability of Yucca Mountain site.	100% completed. Revised program plan completed 5/96.
4.2	Prepare a plan by 9/96 that identifies steps to ensure an aggressive start on interim storage of spent fuel should enabling legislation be enacted.	100% completed. The required steps are incorporated in the revised program plan in Success Measure (1).
4.3	Complete by 3/96, 2.5 miles of exploratory tunnel and begin 2 test alcoves in potential repository formation at Yucca Mountain.	160% completed. 3 miles of exploratory tunnel completed by 3/96; 4 test alcoves completed as of 5/96.

EQ-4

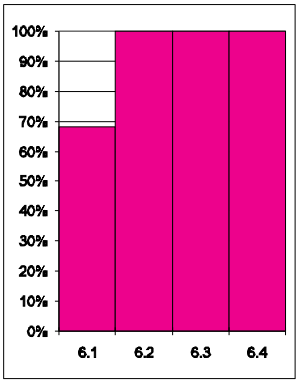


EQ-5: Shut down and clean up surplus non-weapons nuclear reactor sites.		
Success Measure		**Status**
5.1	Complete critical steps to deactivate the FFTF by:	
5.1a	Washing and packaging 56 of 382 FFTF spent fuel assemblies into interim storage casks and placing in secure storage by 9/96.	75% completed as of 6/96. On track.
5.1b	Remove fresh fuel and eliminate unneeded security at the FFTF by 9/96.	Measure missed due to Secretary's independent review of potential use of the FFTF to produce tritium.
5.2	Complete initial steps to deactivate EBR-II by:	
5.2a	Complete 86% of EBR-II fuel removal by 9/96. Remove all fuel from the reactor by 12/96.	98% completed as of 6/96. 84% of EBR-II fuel removed as of 6/28/96.
5.2b	Complete construction of the Sodium Processing Facility by 9/96 to stabilize coolant drained from EBR-II.	75% completed as of 6/96. Construction on schedule for completion by 9/96.

EQ-5

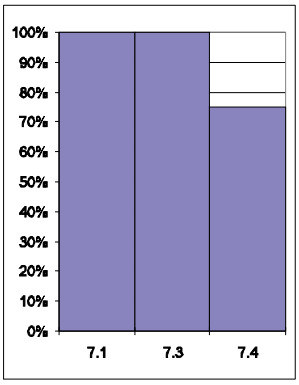


EQ-6



EQ-6: Ensure environmental justice.		
Success Measure		**Status**
6.1	Increase by 74% the removal of organic solvents from soil and groundwater within “A/M” area of Savannah River Site by 9/96.	68% completed as of 6/96. An increase of 50% has been realized.
6.2	Initiate construction of an interim cap to prevent migration of contaminants from Old Burial Ground at Savannah River Site by 9/96.	100% completed. Construction contract awarded 6/96.
6.3	Initiate clean-up activities near East Fork Poplar Creek community at Oak Ridge Site by 4/96.	100% completed. Remediation contract awarded and Phase I clean-up action initiated.
6.4	Implement environmental justice communication strategy plan for affected communities.	100% completed. First issue of “Subsistence and Environmental Health Newsletter” published in May 1996.

EQ-7



EQ-7: Prevent future pollution.		
Success Measure		**Status**
7.1	Issue pollution prevention performance measures and waste reduction goals by 3/96 to be achieved by 2000.	100% completed. Secretary’s pollution prevention goals and 1996 Pollution Prevention Program Plan issued 5/3/96.
7.2	Ensure half of DOE’s purchases of EPA-designed products contain recycled or recovered materials.	Annual reports due from field sites 12/1/96.
7.3	Initiate 20 additional projects in FY 1996 that will yield net savings of at least $30 million over 3-year period.	100% completed. 20 projects initiated by 3/96 with projected annual savings of $19.5 million.
7.4	Complete analysis and issue report by 3/96 concerning contamination resulting from each step of nuclear weapons production to prevent future generation of waste.	75% completed as of 6/96. Measure missed due to severe staff cutbacks and competing projects; report in review with expected completion 9/96.

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Relationship to DOE Strategic Plan Goals

DOE STRATEGIC PLAN (April 1994)	PERFORMANCE INDICATORS
Eliminate Hazards and Releases **Environment, Safety, & Health Goal 1** *Empower workers and take other necessary actions to prevent all serious injuries and all fatalities, and to eliminate all worker exposures and environmental releases in excess of established limits. By eliminating these exposures and releases, reduce the incidence of illness among workers and the public, and prevent damage to the environment.*	1–2. OSH (Lost Workday Case Rate, Cost Index) 3. Electrical Safety 4. Industrial Operations Safety 5. Transportation Safety 7. Reportable Occurrences of Releases to the Environment 9. Environment Permit Exceedances 10. Radiation Dose to the Public 11. Worker Radiation Dose 12. Radiological Events 13. Near Misses and Safety Concerns 14. Inadequate Procedures/Procedures Not Followed 15. Safety System Actuations
Performance Requirements **Environment, Safety, & Health Goal 2** *Ensure there are specific environmental, safety, and health performance requirements for DOE activities which are the basis for measuring progress toward continuous improvement.*	1–2. OSH (Lost Workday Case Rate, Cost Index) 11. Worker Radiation Dose 12. Radiological Events 21. Toxic Chemical Releases
Establish Priorities **Environment, Safety, & Health Goal 3** *Establish clear environmental, safety, and health priorities and manage all activities in proactive ways that effectively and significantly increase protection to the environment and to public and worker safety and health.*	19. Spent Nuclear Fuel and Plutonium Vulnerabilities Resolved 20. Plutonium Stabilization
Demonstrate Performance **Environment, Safety, & Health Goal 4** *Demonstrate respectable performance related to environmental protection and worker/public safety and health.*	All

(Numbers refer to corresponding Sections in this report.)

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Summary of Process

B1. Overview

One of the critical success factors identified in the Department of Energy (DOE) Strategic Plan for environment, safety and health is "ensuring the safety and health of workers and the public and the protection and restoration of the environment." This report describes a new approach for measuring the performance of DOE operations in these areas and thereby supporting management decisions aimed at "ensuring the safety." The general concept is to focus on key factors with the most impact on worker and facility safety and the environment.

Data collection was limited to available data (e.g., ORPS, CAIRS, Site Environmental Reports). The process was non-intrusive and did not expend site resources. As such, the performance indicator components may not sufficiently measure all facets of environment, safety and health. Experience from this report, along with customer feedback from the attached survey form, will be evaluated. Subsequent reports may evolve to include incorporating the components into an index to represent the combined effect that the activities have on the envelope of safety that protects the worker and the environment as experience is gained and data sources improve.

This report was reviewed by a multi-disciplinary team with expertise in nuclear and facility safety, environment, worker safety and health, health studies, and planning/administration. The team is identified in table at the end of this appendix.

B1.1 Initial Performance Measures

The performance measures included in this report are identified in the table below. Selection of the indicators involved both evaluation of the overall safety significance as well as tests of availability. A process was established where all potential indicators were evaluated with respect to significance to the ultimate goal of measuring performance in environment, safety and health. With respect to availability, a decision was made to select indicators from existing data streams to avoid, for now, levying a burden on field activities for additional data. Primarily, indicators are derived from data within four data systems and one annual report:

- *Occurrence Reporting and Processing System (ORPS)* - a system originally designed for notification of nuclear as well as non-nuclear occurrences in the field. For all indicators based on occurrence reports, data prior to 93Q1 has been removed from the graphs and analysis.
- *Computerized Accident/Incident Reporting System (CAIRS)* - a system for collecting data associated with occupational injury and illness events and statistics.
- *Radiation Exposure Monitoring System (REMS)* - a system for collecting data on individual radiation doses received by DOE complex workers.
- *Environmental Compliance Database* - a system maintained by the Office of Environmental Policy and Assistance.
- *Annual Site Environmental Reports.*

There are, of course, limitations resulting from using the data for other than the purpose for which it was collected. Further, the availability of data should not be confused with relevance to measuring performance. Indicators should be selected based on their impact on the operations being examined, not solely because the data exist. Although some of the selected indicators may be of interest to other audiences, it is likely that other valid indicators exist that should be analyzed and trended to provide the appropriate perspective (e.g., facility, contractor, program management) on performance.

PI Component	Data Source
I. Accidents/Events	
1 Lost Workday Case Rate	Computerized Accident/Incident Reporting System, EH-51
2 Occupational Safety and Health Cost Index	Computerized Accident/Incident Reporting System, EH-51
3 Electrical Safety	Engineer Review of Occurrence Reports, Defense Programs Review of Occurrence Reports
4 Industrial Operations Safety	Engineer Review of Occurrence Reports, Defense Programs Review of Occurrence Reports
5 Transportation Safety	Engineer Review of Occurrence Reports, Defense Programs Review of Occurrence Reports
6 Chemical Hazard Events	Quarterly Review of Chemical Safety Concerns/Occurrence Reporting and Processing System, EH-52/EH-53/BNL
7 Reportable Occurrences of Releases to the Environment	Engineer Review of Occurrence Reports, EH-33
8 Cited Environmental Violations/Fines	Environmental Compliance Tracking Database, EH-41
9 Environmental Permit Exceedances	Annual Site Environmental Reports
10 Radiation Dose to the Public	Annual Reports to Environmental Protection Agency (EPA) by Each Site, EH-41
11 Worker Radiation Dose	Radiation Exposure Monitoring System (REMS), EH-52
12 Radiological Events	Engineer Review of Occurrence Reports, EH-33
II. Precursors	
13 Near Misses & Safety Concerns	Engineer Review of Occurrence Reports, EH-33
14 Inadequate Procedures/ Procedures Not Followed	Engineer Review of Occurrence Reports, EH-33
15 Safety System Actuations	Engineer Review of Occurrence Reports, EH-33
16 Safety Equipment Degradation	Engineer Review of Occurrence Reports, EH-33
III. ES&H Management	
17 Environmental Compliance Milestones Met	EM Progress Tracking System (PTS)
18 Open DNFSB Recommendations	Safety Issues Management System (SIMS), S-3.1
IV. Hazards	
19 Spent Nuclear Fuel and Plutonium Vulnerabilities Resolved	Plutonium Vulnerability Management Summary Report, EM-60; Reports on Status of Corrective Actions to Resolve Spent Nuclear Fuel Vulnerabilities, EM-37
20 Plutonium Stabilization	Nuclear Materials Stabilization Task Group Quarterly Report, Data tracked by Brookhaven National Laboratory
21 Toxic Chemical Releases	Annual DOE 3350 Pollution Prevention Report to EPA
22 Pollution Prevention	TBD - Under Development

B2. Data Analysis

B2.1 Analyses Performed

The data analysis results are summarized in the DOE Performance Indicator Report. They are intended to identify areas which should be further investigated (to identify areas that may require intervention as well as good practices to share across DOE); they do not provide absolute answers in themselves. Data analyses include:

- looking for statistically significant trends over time,
- comparison to historical averages or benchmarks (e.g., Bureau of Labor Statistics for similar industries),
- normalization of events to opportunities (e.g., construction related events divided by construction hours worked or construction dollars spent),
- examination for statistically significant trends in types of operations, severity or type of events, and causes.

Typically, the historical baseline is established using existing data excluding the most recent quarter. The two most recent quarters are excluded for data originating from CAIRS to account for the time lag in data reporting.

Where possible, data were analyzed by quarter. In some cases, data were also viewed monthly to reveal any interesting seasonal effects not evident in the quarterly data grouping. Where appropriate, sites were contacted to provide perspective for unusual data values or trends. Data sources for several of these measures are annual; the need for more frequent data must be evaluated for future reports.

The data can also be used to perform other special analyses and reports (such as trends in causes and types of events). These analyses and reports could support special needs, such as oversight preparation and programmatic reviews.

The same approach can be used to perform more detailed functional or programmatic analyses by identifying subsets (peer groups) of DOE facilities for further examination. Examples of peer groups might include: reactors, accelerators, major clean-up sites, waste storage areas, defense chemical facilities, fossil energy sites, laboratories and spent fuel storage facilities.

B2.2 Determining Statistical Significance of Trends

The Multinomial Likelihood Ratio Test (MLRT) is used to determine statistical significance of trends. MLRT performs separate tests for increasing and decreasing trends in a sequence of 2 to 30 counts of an event. The tests are based on a multinomial distribution assumption for the counts. Therefore, the sequence must be counting discrete events that are independent over time. An event is a physically indivisible quantity, such as an incident. These tests are also useful for performing trend analysis of rare events.

MLRT computes a ratio of constant trend likelihood to increasing (or decreasing) trend likelihood from the observed sequence of counts. Therefore, small values of the ratio favor an increasing (or decreasing) trends. Consider the following question: “If the data are generated by a constant trend multinomial model, what is the probability of observing

a smaller ratio than that computed from the observed sequence?" This probability is called the significance level of the test and is interpreted as follows:

Significance Level	Conclusion
> 0.1 to 1.0	no departures from constant trend detected
> 0.05 to 0.1	possible increasing (or decreasing) trend
> 0.01 to 0.05	probable increasing (or decreasing) trend
> 0.001 to 0.01	very probable increasing (or decreasing) trend
0 to 0.001	highly probable increasing (or decreasing) trend

The significance level is analogous to precision of measurement. As always, the importance of any precisely measured (i.e., statistically significant) quantity depends on the subject matter and context.

B3. Future Plans

This report is considered a "work in progress". Since the last report, 4 indicators have been added and 4 have been deleted or combined with other performance indicators. Future activities are focused on obtaining feedback on the approach and improving the effectiveness of the product, including:

- Developing, in partnership with the field organizations, performance indicators that provide a measure of how well DOE is doing in (a) reducing hazards or vulnerabilities and (b) safety management including training, management involvement, and worker involvement. These new measures, combined with measures currently available, will more ably answer the critical questions of "what is DOE's actual and potential impact on people and the environment" and "is DOE getting safer."
- Providing more normalized or risk-based data that lends itself better to analysis and comparison.
- Establishment of Corporate goals for most indicators and comparison to average and best-in-class companies.
- Internet web-based tools to provide up-to-date data and charts of most performance indicators.

Future reports will be refined as data are gathered and customer input is received. Over time, new knowledge and changing missions will be reflected in the process.

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Glossary

Baselines

Baselines provide an historical reference point used to show how the current period compares to past experience. Generally, historical baselines are established using existing data excluding the most recent reporting period. For the data which originates from CAIRS, the two most recent quarters are excluded to account for the lag in data reporting. Baselines established for data originating from occurrence reports are reevaluated each time the governing reporting order changes. In addition, the graphs show the historical baseline ±1 standard deviation to give the reader a feel for the variation associated with the data. For Performance Indicators where there are insufficient data to calculate a meaningful baseline, no baseline is shown on the graph.

Multinomial Likelihood Ratio Test (MLRT)

MLRT is used to determine statistical significance of trends. MLRT performs separate tests for increasing and decreasing trends in a sequence of 2 to 30 counts of an event. The tests are based on a multinomial distribution assumption for the counts. Therefore, the sequence must be counting discrete events that are independent over time. An event is a physically indivisible quantity, such as an incident. These tests are also useful for performing trend analysis of rare events. MLRT computes a ratio of constant trend likelihood to increasing (or decreasing) trend likelihood from the observed sequence of counts. Therefore, small values of the ratio favor an increasing (or decreasing) trend. Consider the following question: "If the data are generated by a constant trend multinomial model, what is the probability of observing a smaller ratio than that computed from the observed sequence?" This probability is called the significance level of the test and is interpreted as follows:

Significance Level	Conclusion
> 0.1 to 1.0	no departures from constant trend detected
> 0.05 to 0.1	possible increasing (or decreasing) trend
> 0.01 to 0.05	probable increasing (or decreasing) trend
> 0.001 to 0.01	very probable increasing (or decreasing) trend
0 to 0.001	highly probable increasing (or decreasing) trend

The significance level is analogous to precision of measurement. As always, the importance of any precisely measured (i.e., statistically significant) quantity depends on the subject matter and context.

Total Effective Dose Equivalent (TEDE)

TEDE = External Dose Contribution + Internal Dose Contribution. Prior to 1993, the method for calculating the internal dose contribution changed from an annual internal dose to a dose committed over 50 years. Although one may expect this change would result in higher reported doses, the elimination of the "legacy" doses from previous years' exposures resulted in lower reported doses.

The following terms are related to occurrence reporting, as required by DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information*.

Occurrence Categories (types of occurrences)

Occurrence categories are arranged into 10 generic groups related to DOE operations and include the following:

- 1. Facility Condition
- 2. Environmental

- 3. Personnel Safety
- 4. Personnel Radiation Protection
- 5. Safeguards and Security
- 6. Transportation
- 7. Value Basis Reporting
- 8. Facility Status
- 9. Nuclear Explosive Safety
- 10. Cross-Category Items

Severity of Occurrence

Severity of occurrence indicates the degree of significance associated with the different types of occurrences.

Unusual Occurrence: A non-emergency occurrence that exceeds the Off-Normal Occurrence threshold criteria; is related to safety, environment, health, security, or operations; and requires immediate notification to DOE.

Off-Normal Occurrence: Abnormal or unplanned event or condition that adversely affects, potentially affects, or is indicative of degradation in the safety, safeguards and security, environmental or health protection, performance, or operation of a facility.

Facility Function

Facility function identifies the type of facility or the activity/function performed by the facility. Possible facility functions are listed below.

- Plutonium Processing and Handling
- Special Nuclear Materials Storage
- Explosive
- Uranium Enrichment
- Uranium Conversion/Processing and Handling
- Irradiated Fissile Material Storage
- Reprocessing
- Nuclear Waste Operations
- Tritium Activities
- Fusion Activities
- Environmental Restoration Operations
- Category “A” Reactors
- Category “B” Reactors
- Solar Activities
- Fossil and Petroleum Reserves
- Accelerators
- Balance-of-Plant (e.g., offices, machine shops, site/outside utilities, safeguards/security, and transportation)

Causes of Occurrences

Causes of occurrences are determined by performing event investigations and may be identified as direct, contributing, or root causes.

- Direct Cause: The cause that directly resulted in the occurrence.
- Contributing Causes: The cause(s) that contributed to the occurrence but, that by itself, would not have caused the occurrence.
- Root Cause: The cause that, if corrected, would prevent recurrence of this and similar occurrences.

Cause categories are selected from the following:

1. Equipment/material problem: An event or condition resulting from the failure, malfunction, or deterioration of equipment or parts, including instruments or material.
2. Procedure problem: An event or condition that can be traced to the lack of a procedure, an error in a procedure, or procedural deficiency or inadequacy.
3. Personnel error: An event or condition due to an error, mistake or oversight. Personnel errors include inattention to details of the task, procedures not used or used incorrectly, communication problems, and other human errors.
4. Design problem: An event or condition that can be traced to a defect in design or other factors related to configuration, engineering, layout, tolerances, calculations, etc.
5. Training deficiency: An event or condition that can be traced to a lack of training or insufficient training to enable a person to perform a desired task adequately.
6. Management problem: An event or condition that can be directly traced to managerial actions or methods. Management problems include inadequate administrative control, work organization/planning deficiency, inadequate supervision, improper resource allocation, policies not adequately defined, disseminated or enforced, and other management problems.
7. External phenomenon: An event or condition caused by factors that are not under the control of the reporting organization or the suppliers of the failed equipment or service.
8. Radiation/hazardous material problem: An event related to radiological or hazardous material contamination that cannot be attributed to any other causes.

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Product Improvement Survey Form

Purpose of the Product - The Office of Operating Experience Analysis and Feedback, EH-33, is developing a set of indicators for measuring the performance of DOE operations in the areas of Worker Safety and Health and the Environment. The indicators are intended to measure the Department's success in its strategic goal to manage and improve its environmental, safety, and health (ES&H) performance. The major customers for these indicators are expected to be the senior leadership of DOE.

In order to assess the effectiveness of this new performance indicator report, we would appreciate your assistance by providing responses to the following (check one):

1.	Do you use indicators to measure performance?	❑ Yes	❑ No
2.	Do you feel that improved methods for measuring performance are needed?	❑ Yes	❑ No
3.	Would you make management decisions based on this kind of information?	❑ Yes	❑ No
4.	Does DOE-wide ES&H performance matter to you?	❑ Yes	❑ No

5. What are your information needs with regard to measuring Department-wide ES&H success:

- ❑ Quick pulse of the Department ES&H success
- ❑ Light detail concerning the Department ES&H success
- ❑ Moderate detail concerning the Department ES&H success
- ❑ I have no need for this information on a regular basis

Report Evaluation - From your review of this report, ***and in consideration of the purpose stated above***, mark the number that most closely corresponds to your reaction to the following statements

		Strongly Agree			***Neutral***			***Strongly Disagree***
6.	The performance indicators are relevant to the measurement of overall DOE ES&H performance.	⑦	⑥	⑤	④	③	②	①
7.	The report layout (text and graphics) is logical and easy to understand.	⑦	⑥	⑤	④	③	②	①
8.	The data presented in this report are consistent with my impressions of DOE's ES&H performance.	⑦	⑥	⑤	④	③	②	①
9.	The performance indicators provide a "balanced" view (e.g., successes and problems) of DOE's ES&H performance.	⑦	⑥	⑤	④	③	②	①
10.	This report concept can help measure DOE's success in managing and improving its ES&H performance.	⑦	⑥	⑤	④	③	②	①
11.	This report concept can be useful in communicating information on DOE's ES&H performance to external customers.	⑦	⑥	⑤	④	③	②	①

12.	Would you be willing to expend time/travel funds to participate in product improvement sessions?	❑ Yes	❑ No
13.	Would you be willing to expend time/travel funds to participate in product improvement sessions?	❑ Yes	❑ No

Mail or FAX to:

Tom Rollow (FOR) / **Rich Day** (CXXI/GTN)
Office of Operating Experience Analysis, EH-33
U.S. Department of Energy
Washington, DC 20585

FAX number: (301) 903-2329 Page 1 of _____

From:

Name _____

Organization _____

Phone _____

Comments: What additional parameter(s) should be monitored and where could the data be obtained? Consider changes required to make this report more useful for your needs and any general observations based on your review. Use additional pages as necessary.